CONTACT

SECRETARIAT
4th INTERNATIONAL CONFERENCE ON POSTGRADUATE EDUCATION
LEVEL 5, UKM-GRADUATE SCHOOL OF BUSINESS
UNIVERSITI KEBANGSAAN MALAYSIA, 43600 UKM BANGI,
SELANGOR DARUL EHSAN, MALAYSIA

Tel + 03-8921 4719 / 4207 / 4484 / 3140
Email: icpe4@ukm.my
Website: www.ukm.my/icpe4

PROCEEDING ICPE-4 2010
4th INTERNATIONAL CONFERENCE ON POSTGRADUATE EDUCATION

PROCEEDING
ICPE-4 2010
4th INTERNATIONAL CONFERENCE ON POSTGRADUATE EDUCATION

"Globalisation and Liberalisation of Postgraduate Education"

26 - 28 November 2010 | Cititel Mid Valley, Kuala Lumpur

Organised by:

In cooperation with:

Hosted by:

+ CENTRE FOR GRADUATE MANAGEMENT, UKM &
+ UKM-GRADUATE SCHOOL OF BUSINESS

In collaboration with:

ICPE 4 2010

4th International Conference on Postgraduate Education

26 - 28 November 2010

Globalisation and Liberalisation of Postgraduate Education

Organised by:

- Ministry of Higher Education
- Graduate Studies Deans Council
- Centre for Graduate Management, UKM
- UKM-Graduate School of Business

ORAL: SCIENCE AND TECHNOLOGY

POSTER: BUSINESS AND ECONOMICS

POSTER: SCIENCES AND TECHNOLOGY

ORAL

BUSINESS AND ECONOMICS

Conceptual Framework of the Relationship between Advertising (Affective, Cognitive Processing Style) and Luxury-Seeking Buyers

Ehsaneh Nejad-Mohammad
UKM-Graduate School of Business
Ehsaneh_nameghi@yahoo.com

Abstract
In this paper, we try to find the luxury seeking buyers advertising processing style.

Keywords
Affective, Cognitive, Veblenian, Hedonist, Snob

INTRODUCTION

The effectiveness of advertising to consumers has been discussed in different perspectives, such as in the consumer involvement, (Anthony G. Green Wald Clark Leavit 1984) Lots of research has been done concerning the relationship between advertising and consumer responses (LaBarbera et al., 1998), while some where focusing in the advertising as programming and planning tool for goods and services for consumers (A. S. Belenky, Nistraman Consulting, 2000), Effects of comparative advertising format on consumer responses (Mehmet I. Yagci, Abhijit Biswas, Sujay Dutta, 2009), introducing model by using advertising and consumer search (Maarten C.W. Janssen, Marielle C. Non, 2007), defining a model for relating advertising media exposure to purchase behavior intention (Fred S. Zufryden, 1987), some research approach is including advertising dimensions such as hedonic & Utilitarian (Thomas J. Olney Morris B. Holbrook Rajeev Batra, 1991) while some where concentrated about the consumers processing (affective/ cognitive) style of advertising appeals. (Salvador Ruiz, Marı´a Sicilia, 2004).in fact the role of affection in understanding the ad by consumers has been approved. (Julie A. Edell Marian CHAPMAN BURKE, 1987), but the affection and cognition role, on luxury and prestige seeker has not been clarified.

Vigneron (1999) shows the origin of defining luxury buyers starting by defining concepts by different researchers such as Bourne (1957), (Mason 1981 and 1992; Bearden and Etzel 1982), (Braun and Wicklund 1989; Hong and Zinkhan 1995; Bagwell and Bernheim 1996; Corneo and Jeanne 1997). Thorstein Veblen (1899), Leibenstein (1950), (Mason 1981, 128). Pantzalis (1995), (Mason 1992). (Verhallen 1982; Lynn 1991; Pantzalis 1995). (Dubois and Duquesne 1993). He defines luxury buyers based on five motivations in to five segments (Snobs, Bandwagons, hedonists, Perfectionist and veblenians (conspicuous seekers), while some other researchers define luxury buyers according to consumer preference to buy luxury products, dividing them in to Excursionists, Elitists, Distance. (Dubois 2001), while according to (Bernard Dubois et al, 2005) people according to their attitude in different countries, have been segmented in to (democrats, Elitists and Distance seekers).

This research tries to find the relationship between luxury buyers based on definition of Vigneron and Johnson (1999) and the affective/Cognitive adverting discussed by (Salvador Ruiz, Marı´a Sicilia, 2004). The contribution of this research is defining better luxury buyers behavior and helping scholars and researchers to find out more about luxury-seeker consumers in order to reach a better programming and Organizing for high status or so called luxury brand market as some researchers try to approach that (Glyn Atwal, Alistair Williams, 2009).

LUXURY-SEEKING BUYERS

Veblenians:

The world veblenian is used because of the Thorsthein Veblen (1899) who first explained the term Conspicuous consumption for luxury buyers as a signal of wealth and showing power and status, in fact prestige products usage is showing and displaying wealth and power.

Veblenians according to definition are buyers which give importance to price as an indicator of prestige while the people's idea about their situation is important for them. Consumers, who see price as an indicator of quality, perceive price also as an indicator of Prestige (Lichtenstein, Ridgway, and Netemeyer 1993). While sometimes veblenians are defined as people who pay higher price for functionally similar chip goods (Laurie Simon Bagwell & B. Douglas Bernheim, 1996). According to Daniel Piette, vice-president of LVMH (a French conglomerate that owns Louis Vuitton, Moet ET Chan- don, and Christian Dior perfumes), for many individuals buying luxury goods "is all about demonstration. The Economist (1993 p. 97). We can argue that conspicuous oriented buyers or so called Veblenians give importance to the social status that brand brings and price as an indicator of prestige.

SNOB

Scarcity of product or being uniqueness is another approach that consumers may have in order to choose the products. This phenomena has been defined by researchers' as a distinction (Thorsthein Veblen1899), Snobbism: the desire of people to be exclusive, to be different, to dissociate themselves from a "common her herd" (Leibenstein, 1950), scarcity value and signaling superior level of social status by using expensive scary product (Mason ,1981/1982 & Heribert Gierl, Verena Huettl,2010). Vigneron (1999) argues that snob is recognizable within two situations, when a new prestige product is produced and consumers buys in order to gain from its scarcity and limited number of production and when a product is consumed by mass, the snob oriented consumer rejects to buy a product. Snob oriented consumers see price as an important indicator of prestige while are more based on the personal effects rather than interpersonal effect. We can compare snob seeker consumers by "Elitists" who believe luxury products are for small proportion of consumers, mentioned as "small Happy" (Dubois, Czellar & Laurent, 2005).

Bandwagon

Bandwagon effects refers to the increasing the demand for commodity because of increasing the usage of commodity by others, in fact bandwagon refers to be in mode.(Leibenshtien 1950).using the luxury brand for bandwagons is to be distinguished from others (Holt,1995).having luxury brand is more valuable or so called appreciated by materialistic consumers. (Bearden, Netemeyer, and Teel 1989; Richins 1994). Materialism, is the belief saying possession brig happiness (Belk, 2001) and give to material goods, high importance that makes it something important for individual happiness (Luciana de Araujo Gil, 2009).

Bandwagons are people who see "reference group" as their source to purchase luxury. (William O. Bearden Michael J. Etzel, 1982) explains "reference groups," by definition of (Merton and Rossi 1949) as a People orientation in order to shape their behavior and evaluations which reference groups can perform a diversity of functions.

Hedonist

Hedonism is a term that has been discussed by researchers. Dichter (1960) argue that consumers choice sometime might be not cognitive but more emotional. (Vigneron, 1999) says Hedonic dimension refers to luxury dimension reflected by sensory Gratification (Rossiter and Percy, 1997) and sensory pleasure (Hirschman and Holbrook, 1982) expected from the consumption. In fact hedonism refers to enjoying situation, life is more beautiful with more pleasure, (Dubois & Laurent 1994, 1996) Hedonic consumers don't care about others idea while they don't see Price as an important indicator of prestige, in fact, people who have their own opinion (Kassarjian,1965) are more personal type rather than in-personal can be perceived as a hedonist consumers, some researchers go further and define Hedonism by factors scaling consist of: adventure, gratification, role, value, social, and idea. Mark J. Arnold, Kristy E. Reynolds, 2003).

Perfectionist

(Vigneron, 1999) defines Perfectionist as consumers who seek quality more than anything else. They don't care so much about the price as an indicator prestige. Perfectionist consumers may perceive more value from a luxury brand because they may assume that it will have a greater brand quality and reassurance (Aaker 1991).one of the reason that people buy luxury products is because of the quality that may perceive from having them while high prices also shows the qualification of a product and make them desirable. (Groth and McDaniel 1993, 10).

CONSUMER & ADVERTISING

Lot of research has gone through advertising and consumer response. In fact two components have been seen important in consumer response, Affective or so called emotional processing style and Cognitive response. How do people cognitively react to persuasive communications (Daniel R. Toy, 1982).while some where focusing on women consumers cognitive response to commercial message (Peter Wright, 1975) and children cognitive response to ad using non directive probes (Merrie Brucks Gary M. Armstrong Marvin E. Goldberg, 1988), other researchers tries to see a cognition on satisfaction response (Richard L. Oliver,1993) and emotion mediating role in consumer response to ad has been discussed (Morris B. Holbrook Rajeev Batra, 1987/ Julie A. Edell Marian Chapman Burke, 1987).

Some research argue that emotional advertising has more affection on low-involvement, hedonic or can say emotional products while that not affect so much high-involvement consumers and utilitarian products (Maggie Geuens, Patrick De Pelsmacker, Tine Faseur, 2010). We can argue that can be true for bandwagons as well, meaning that emotional advertising may have more affection on them even if they want to buy high-involvement product.(e.g. if they want to buy a watch or car, they decision procedure is more based on emotion because of their behavioral characteristic which is more based on mode and imitating fashion and famous people such actors, artists.)

H1: the affection of emotional advertising is more on Bandwagon buyers.

Hedonic and perfectionists are more inner-oriented people, meaning they are more related to the multisensory, fantasy, and emotive aspects of consumption (Hirschman & Holbrook, 1982).in fact

shopping motivation for hedonistic consumers has been defined as :adventure, gratification, role, value, social, and idea (Mark J. Arnold, Kristy E. Reynolds, 2003), but whether they focus about enjoying from buying (emotion processing style), their decision processing style is not just only emotional but also shows that to be based on thinking meaning that they even want to buy goods that they like they also think about the product and its features and specially its quality because, Hedonic shopping motives are similar to the task orientation of utilitarian shopping motives, only the "task" is concerned with hedonic fulfillment, such as experiencing fun, amusement, fantasy, and sensory stimulation (Babin et al., 1994).

H2: the effect of Cognition or so called thinking processing style & Emotion or affective Processing style is more on Hedonic and Perfectionists.

Snob consumers are those who don't like to buy when a demand for a certain product increases (Giacomo Corneo, Olivier Jeanne, 1996) because they really want to be unique and they in fact see whether a product or good is something rare and not so popular in the market, they see themselves as an elite so in fact their processing style is based more on Cognition rather than emotion and they would be more interested on advertising which show a product is unique or can say that is more informational because of the fact that in informational ads the semantic judgment is more important than emotional & feeling.

H3: The effect of Cognition or so called thinking processing style is more on SNOB consumers but less than Hedonist & Perfectionist.

Veblenian are those consumers who see price as an indicator of prestige and they also are more sensitive about people, media, advertisement because of public perspective on the axis of self-consciousness (vigneron, 1999), they are somehow the same as bandwagons but the main difference between this two group is that bandwagon are function consumption but Veblenians are function of price (has high importance for them (H. Leibenstein, 1950). We can conclude that veblenians because of the importance that they give to others idea are more sensitive regarding the emotional advertising.

H4: The effect of emotion or affective processing style in Veblenians is more comparing with the Cognition.

METHODOLOGY

In order to see the relationship between Luxury buyers and Consumers processing style (Cognitive or affective) and response to advertising, we can define sample from university students because of the fact that Student sample is homogeneous (Peterson, 2001) and as Kapferer in 1998 mentioned, students are actual or potential customers of luxury goods (Bernard Dubois, Sandor Czellar, Gilles Laurent, 2005). We will choose students who have bought at least 3luxury items within 2 past years or 3 exceptional products in last 3 years, according to the definition of luxury buyers (Melika Husic and Muris Cicic, 2009). Our questionnaire is designed in 3 stages:

1. Questions relating to buying luxury (to find category of luxury product buyers; Snob, Veblenian, Bandwagon, Hedonist & Perfectionist).
2. Questions relating to luxury-seeking Processing styles (Cognitive or affective) and advertising response.
3. Demographic Questions.

Table 1: Luxury seekers position in Advertising Processing style continuum

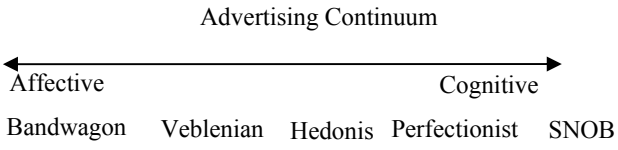
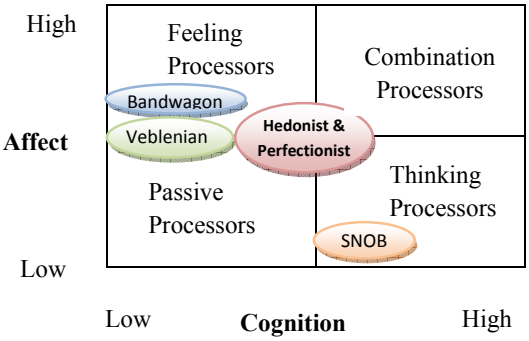


Table2: Luxury seekers position in processing style matrix



REFERENCES

[1] Frank Vigneron, Lester W. Johnson (1999). *A Review and a Conceptual Framework of Prestige-Seeking Consumer Behavior,* Academy of marketing science review Volume 1999 No.1

[2] Bernard Dubois. Sandor Czellar. Gilles Laurent (2005). *Consumer Segments Based on Attitudes Toward Luxury: Empirical Evidence from Twenty Countries,* 2005 Springer Science + Business Media, Inc. Manufactured in the Netherlands.

[3] Salvador Ruiz, Mari´a Sicilia(2004).*The impact of cognitive and/or affective processing styles on consumer response to advertising appeals,* Journal of Business Research 57 (2004) 657– 664

[4] Melika Husic and Muris Cicic (2009). *Luxury consumption factors,* Journal of Fashion Marketing and Management, Vol. 13 No. 2, 2009 pp. 231-245

[5] Anthony G. Greenwald and Clark Leavitt (1984). *Audience Involvement in Advertising: Four Levels,* The Journal of Consumer Research, Vol. 11, No. 1 (Jun., 1984), pp. 581-592

[6] H. Leibenstein (1950). *Bandwagon, Snob, and Veblen Effects in the Theory of Consumers' Demand,* The Quarterly Journal of Economics, Vol. 64, No. 2. (May, 1950), pp. 183-207

[7] Fred S. Zufryden (1987). *A Model for Relating Advertising Media Exposures to Purchase Incidence Behavior Patterns,* Management Science, Vol. 33, No. 10 (Oct., 1987), pp. 1253-1266.

[8] LaBarbera PA, Weingard P, Yorkston EA. Matching the message to the mind: *advertising imagery and consumer processing styles.* J Advert Res 1998; 38:29 – 43 (September/October).

[9] A. S. BELENKY, NISTRAMAN (2000). *An Approach to Planning an Advertising Campaign of Goods and Services*. Computers and Mathematics with Applications 42 (2001) 993-1008

[10] Mehmet I. Yagci , Abhijit Biswas , Sujay Dutta(2009). *Effects of comparative advertising format on consumer responses: The moderating effects of brand image and attribute relevance.* Journal of Business Research 62 (2009) 768–774

[11] Maarten C.W. Janssen a, Marielle C. Non (2007). *Advertising and consumer search in a duopoly model.* International Journal of Industrial Organization 26 (2008) 354–371

[12] James H. Pedrick and Fred S. Zufryden(1991). *Evaluating the Impact of Advertising Media Plans: A Model of Consumer Purchase Dynamics Using Single-Source Data*, journal of marketing science Page 111 of 111-130

[13] Thomas J. Olney, Morris B. Holbrook, Rajeev Batra (1991). *Consumer Responses to Advertising: The Effects of Ad Content, Emotions, and Attitude toward the Ad on Viewing Time,* The Journal of Consumer Research, Vol. 17, No. 4 (Mar., 1991), pp. 440-453.

[14] Julie A. Edell and Marian Chapman Burke. *The Power of Feelings in Understanding Advertising Effects,* The Journal of Consumer Research, Vol. 14, No. 3 (Dec., 1987), pp. 421-433

[15] Mehmet I. Yagci, Abhijit Biswas, Sujay Dutta (2009), *Effects of comparative advertising format on consumer responses: The moderating effects of brand image and attribute relevance,* Journal of Business Research 62 (2009) 768–774

[16] Glyn Atwal, Alistair Williams(2008*),Luxury brand marketing — The experience is everything,* Journal of brand Management Vol. 16, 5/6, 338–346

[17] Thorsthein Veblen (1899),*The theory of leisure class,* republished on 2008 by forgotten books.

[18] LaBarbera PA, Weingard P, Yorkston EA (1998). *Matching the message to the mind: advertising imagery and consumer processing styles.* J Advert Res 1998; 38:29 – 43 (September/October).

[19] Peterson, Robert A. (2001). "*On the Use of College Students in Social Science Research: Insights from a Second-Order Meta-Analysis*," Journal of Consumer Research 28 (December), 450–461.

[20] Lichtenstein, Donald R., Peter H. Bloch and William C. Black (1988), *"Correlates of Price Acceptability,"* Journal of Consumer Research, 15 (September), 243-252.

[21] Laurie Simon Bagwell and B. Douglas Bernheim (1996). *Veblen Effects in a Theory of Conspicuous Consumption.* The American Economic Review, Vol. 86, No. 3 (Jun., 1996), pp. 349-373

[22] Mason, Roger S. (1981), *Conspicuous Consumption,* New York: St. Martin's Press.

[23] Daniel R. Toy (1982). *Monitoring Communication Effects: A Cognitive Structure/Cognitive Response Approach.* The Journal of Consumer Research, Vol. 9, No. 1 (Jun., 1982), pp. 66-76

[24] Merrie Brucks, Gary M. Armstrong, Marvin E. Goldberg(1988). *Children's Use of Cognitive Defenses Against Television Advertising: A Cognitive Response Approach.* The Journal of Consumer Research, Vol. 14, No. 4 (Mar., 1988), pp. 471-482

[25] Morris B. Holbrook and Rajeev Batra (1987). *Assessing the Role of Emotions as Mediators of Consumer Responses to Advertising.* The Journal of Consumer Research, Vol. 14, No. 3 (Dec., 1987), pp. 404-420Published.

[26] William O. Bearden and Michael J. Etzel (1982). *Reference Group Influence on Product and Brand Purchase Decisions.* The Journal of Consumer Research, Vol. 9, No. 2 (Sep., 1982), pp. 183-194

[27] Mark J. Arnold, Kristy E. Reynolds (2003).*Hedonic shopping motivations.* Journal of Retailing 79 (2003) 77–95

[28] Richard L. Oliver (1993). *Affective, and Attribute Bases of the Satisfaction Response.* The Journal of Consumer Research, Vol. 20, No. 3 (Dec., 1993), pp. 418-430.

[29] Maggie Geuens, Patrick De Pelsmacker, Tine Faseur (2010). *Emotional advertising: Revisiting the role of product category.* Journal of Business Research (2010) 9 pages.

[30] Holbrook, Morris B., & Hirschman, Elizabeth C. (1982). The experiential aspects of consumption*: Consumer fantasies, feelings, and fun.* Journal of Consumer Research, 9(March), 132–140

[31] Aaker, David (1991), *Managing Brand Equity: Capitalizing on the Value of a Brand Name*, New York: Free Press.

[32] Holt, Douglas B. (1995), *"How Consumers Consume: a Typology of Consumption Practices,"* Journal of Consumer Research, 22 (June), 1-16

[33] Kassarjian, Harold H. (1965), *"Riesman Revisited"* Journal of Marketing, 29 (April), 54-56.

[34] Bearden, William, Richard G. Netemeyer and Jesse E. Teel (1989), "*Measurement of Consumer Susceptibility to Interpersonal Influence*," Journal of Consumer Research,15 (March), 473-481.

Opportunity Recognition and The Process of Transfering Silage Technology

Rozhan Abu Dardak, Ghazali Husin, Aliah Hanim Mohd Salleh,
Khairul Akmaliah Adham and Halimah Badioz Zaman
Graduate School of Business, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Malaysia.
rozhan@mardi.gov.my

Abstract
Technological innovation initiatives by government research institutions (GRI) and public universities (PU) do offer crucial business opportunities to private firms (PF). Private firms need to recognize and capitalize on these opportunities for new products to remain competitive in business. The GRIs with their mandate on technological innovation need to ensure the products benefits the society and contributes to economic development. This single case study highlights a process of technology transfer of OTOSIL Silage Machine from MARDI (GRI) to Choon Heng Engineering Sdn Bhd (PF). It attempts to answer major questions on how opportunity is recognized and created from market needs; and how the new technology is transferred between the parties. The focus is on the relationship between opportunity recognition and technology transfer in the context of agro-based technology through the licensing of intellectual property (IP). The findings indicated that both the OTOSIL technology generator and technology receiver did mutually recognized the opportunities and benefits from transfer of the silage technology. It thus confirms that opportunity recognition is a highly significant factor for a successful technology transfer from government research institutions to private firms.

Key words
Opportunity recognition, technology transfer process, technology generator, technology recipient

INTRODUCTION

Opportunity recognition (OR) is an important dimension of entrepreneurial process in recognizing new opportunities available in an industry. Entrepreneurs seek new opportunity to generate potential profit. Private firms often look up to government research institutions and public universities as a source for new technological innovation, as it can reduce the cost of the developing new products (Kamariah, Wan Zaidi and Izaidin 2009). The high cost of developing new technology compounded by global economic crisis have forced private firms to reduce their investment in R&D and seek technology from government research institution and public universities (Parker et al. 2001). On the other hand, government research institutions not only mandated to develop and transfer the products of their R & D technological innovation to reach the market place, but also to ensure they create large scale impact on national economic development.

In Malaysia, the lack of technology transfer in various sectors has led to low percentage of technology being adopted by the industries and consumers. For example, out of more than 5, 200 projects implemented by government research institutions and public universities during the 6th and 7th Malaysia Plan, only 14.1% was identified as potential candidates for commercialization, and only 5.1% was commercialized (MOSTI 2008). The process of technology transfer from government research institution to private firm was considered as the most challenging and critical (Bozeman 2000). The technology transfer process is dynamic, not uniform across organizations (Kremic 2003).

Given the potential impact of innovation and technology transfer on national economic development, this study attempts to answer the question: how opportunity is discovered and created from market needs; and how new technology is transferred from a government research institution to a private firm in the context of Malaysian agro-based technology. Thus, this study aims to understand the relationship between opportunity recognition and technology transfer; and the process of technology transfer of OTOSIL Machine technology from MARDI (GRI) to the private firm - Choon Heng Engineering Sdn Bhd (PF). This study focuses the process of agro-based technology transfer through the licensing of intellectual property (IP) in Malaysia.

METHODOLOGY

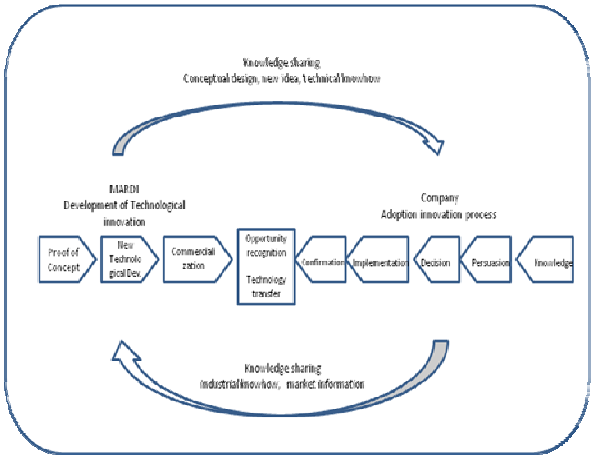
This single case study employed the process-explanatory research design on Malaysian agro-based technology industry as the research setting. The selection of qualitative research paradigm was aimed at an in-depth understanding of the phenomenon of technology transfer process from GRI to a private firm, from the perspective of both technology generator and technology recipient. The technology transfer involved in this study was that of OTOSIL Silage Machine technology between the MARDI (GRI) and the private firm was Choon Heng Engineering Sdn Bhd – fabricator of agriculture machinery for animal feed industry.

The data collection involved studying the activity processes that MARDI and private firm has engaged, in the development, transfer and marketing of the technology. In addition, secondary data from government and company reports, public documents and specialized publications were also analyzed. Intensive in-depth interviews were conducted with major stakeholders in the technology transfer. These include two major players such as Mr Ghazali Husin (a technology generator/MARDI researcher) and the Mr. Tan Hock Fatt of Choon Heng Engineering Sdn Bhd. (technology recipient). Both respondents were interviewed in depth using semi-structured questionnaires, which were recorded and later transcribed.

CONCEPTUAL FRAMEWORK

The conceptual framework of this case study is illustrated as in Figure 1.0.

Figure 1.0: Conceptual framework of technology transfer process



The conceptual framework of this study is developed based on four underpinning theories: the entrepreneurship theories; innovation processes; knowledge sharing; and diffusion of innovation. This framework shows a reciprocal relationship between MARDI as the technology transfer and the private firm as a technology receiver. Technology transfer involves interactive activities by the people from both organizations. In this study opportunity recognition is defined as the capability of a person sensing, discovering and creating fit in certain market needs and underemployed/ specific resources to form a new business concept. On the other hand, technology transfer is transferring the right to use/ manufacture / marketing the product of GRI research and development, in exchange of a payment.

FINDINGS

The MARDI process of technology transfer is divided into five stages: i) the development of new technology, ii) the evaluation of a technology and approval for commercialization by MARDI committee for technology management, iii) pre-commercialization, iv) commercialization, and v) post commercialization. The development of new technology is carried out by research officers from the respective research centers. In the case of silage technology, the OTOSIL machine was invented by Mr Ghazali Husin of Livestock Strategic Research Center. It is a machine specially developed for making silage for animal feed.

The development of OTOSIL machine began in 1999. The idea of inventing the machine was originated from the traditional process of the production of silage. The idea of developing the machine was shared with Mr Ah Fatt, who has more than 20 years in the business of modification and fabrication of agriculture machinery. Mr Ghazali designed the machine and both of them amended the design and modified the prototype machine several times until it became a marketable machine. Nevertheless, as the original aims of developing this machine was to resolve the difficulty in the production of silage by the manual means, the technology generator did not yet then recognize the market potential of this technology.

The initial decision to exploit the opportunity of silage technology was initiated by the Director of Livestock Research Center in 2000, who recognized the potential contribution of this technology to animal feed industry. This machine could significantly increase silage production and eventually enhance the animal feed industry. The process began when the technology was evaluated and approved for commercialization by MARDI committee for technology management in 2006. The criteria for evaluation includes: (i) proof of concept, (ii) novelty of innovation, (iii) its competitiveness as compared to existing technology, and (iv) potential market. After the approval, the technology generator undertook the initiatives in promoting the technology at national and international expositions and innovation competitions. The promotions were carried out in national expositions such as at Malaysia Agriculture, Horticulture and Agro-tourism Exhibition (MAHA), Malaysia Technology Exposition and international technology competitions in Geneva, Switzerland. The promotions and press statements by Mr Ghazali and the management of MARDI, had created awareness among entrepreneurs who recognized the potential of this silage technology to their business profitability. As a result, many entrepreneurs requested for business collaboration. The selection of industry partner was determined by Mr Ghazali based on his confidence with Mr Ah Fatt's industrial capability, experience in machine fabrication and long term business experiences.

The silage technology was officially transferred from MARDI to Choon Heng Engineering Sdn Bhd on 6th April 2007 when Datuk Dr. Abdul Shukor Abd Rahman, the Director General of MARDI and Mr Tan Hock Fatt, Managing Director of Choong Heng Engineering Sdn Bhd signed the technology licensing agreement. After the agreement, the technology generator continued to exchange the technological knowledge and market potential with the partner in return for the industrial know-how. The exchange of knowledge occurred continuously from idea generation until the marketing of the technology. The process of adoption of technology by the industry partner began upon recognition of the benefit of the technology to the business. The entrepreneur`s confidence in the technology and its potential to generate business profit facilitated the process of transfer significantly. The technology transfer has contributed around 10-15% a year to Choong Heng Engineering Sdn Bhd. annual profit. At the same time MARDI has been receiving around RM50, 000 a year in term of royalties from the commercialization of this technology. Hence , in the case of silage technology, the key success factors for technology transfer process are i) compatibility of technology with the industry (technology-industry match), ii) strategic selection of industry partner and the partner's capability in the production of technology, iii) commitment and willingness of technology generator to share strategic knowledge with technology recipient.

CONCLUSIONS

In the case of silage technology, commercial and economic viabilities were the ultimate aim in the recognition of the opportunity by both technology generator and technology recipient. Financial incentives in terms of royalty, and both professional and personal satisfactions were the motivations for researchers or technology generators at MARDI to transfer their technology. On the other hand, the entrepreneur recognized the contribution of this silage technology to his business profitability. In other words, both technology generator and technology receiver mutually recognized the opportunities and benefit from transfer of the silage technology. In the context of agro-based technology, this study confirms that opportunity recognition is a highly significant factor for a successful technology transfer from government research institution to private firm. Opportunity recognition indeed plays a pivotal role in providing strong initiatives and linkages for technology transfer process to successfully occur.

REFERENCE

[1] Bozeman, B. (2000). Technology transfer and public policy: a review of research and theory. *Research policy* vol: 29, 627-655.

[2] Kamariah, I., Wan Zaidi, W.O., and Izaidin A.M. (2009). The decision making process in University spin-offs formation. Is it the role of Technology Transfer Office? Proceeding of Asia Pacific Marketing Conference, 2009.

[3] Kremic, T. (2003), Technology transfer: A contextual approach. Journal of technology transfer vol 28, 149-158.

[4] MOSTI (2008). National survey of research and development. Malaysian Science and Technology Information Centre, Putrajaya.

The Impact of Structural Empowerment on Lecturers' Job Satisfaction: Research Universities in Malaysia

Sahar Ahadi[1,*], Turiman Suandi [2], Maimunah Ismail [3], And Zoharah Omar[4]
[1, 2, 3, 4] Universiti Putra Malaysia
*Sahar_ahadi1@yahoo.com

Abstract
The purpose of this study was to investigate the relationship between lecturers' structural empowerment and job satisfaction in Malaysia based on Kanter empowerment theory. A sampleof195 lecturers employed in four research universities in Malaysia was used in the present study the results showed that structural empowerment is a predictor of job satisfaction. Six dimension of structural empowerment were significantly related to the lecturers' job satisfaction. University administration must make their efforts to provide organizational structures that increase lecturer's satisfaction in their workplaces.

Keywords
Structural empowerment, job satisfaction, research universities, higher education

INTRODUCTION

Faculty members comprise a large percentage of the educational institution. They are the ones who carry out the mission and who endeavor to accomplish the goals of the institution. In the other hand, like any profession faculty work and exist within their universe of norms, standards, expectations [1]. One of The major goals of the National Education Development Plan 2001-2010 is to produce a world-class education system. In Malaysia, education plays a very important role in enhancing the national economy. The country Malaysia decided to upgrade the existing institutions to become research world-class universities [2]. Policymakers in Malaysia now understand that higher education plays an important role in the success of modern society. It seems that this responsibility is related more to research universities than the other universities in Malaysia. Research Universities responsible for the creation of new knowledge [3] to generate intellectual capital, advance technology, participate effectively in knowledge-based economic development and develop knowledge linking activities to enhance science and technology transfer and commercialization.

But to perform effectively, universities face with plenty of difficulties. Except the academic environment of research, rapid expansion of higher education, the competition with higher education institutions, low salary of lecturers in comparison with industrial sectors, competition for research funds, performance-based evaluation create more complex and workload and pressure environment for the lecturers in Malaysia, meanwhile in terms of organizational factors, organizations that experience major changes or transitions have an increased likelihood of their employees experiencing powerlessness [4].

Changes in the educational organizations have the potential to influence the roles of its human resources, and meanwhile their perception towards their careers. All challenges to research universities affect the academic profession in one way or other [5]. Changes and challenges result in decreasing of the academic staff satisfaction. The areas of greatest dissatisfaction include having too much responsibility and workload, limited participation in decision making, limited opportunity, and lack of resources and support. When lecturers as employees have access to structurally empowering conditions (resources, information, opportunities, and supports) then they are able to achieve their work goals, thereby enhancing their perception that their work has both meaning and impact, all of which lead to increased job satisfaction [6]. These findings show current shortage of study on structural empowerment and job satisfaction in research universities. In other hand, majority of these researches has been conducted in western settings and in health care area. So, it is important to investigate the emphasis on contribution of structural empowerment with job satisfaction in educational institutions.

LITERATURE REVIEW

Structural empowerment leads to increased work effectiveness. Numerous studies have linked the effects of structural empowerment to job satisfaction [7],[8],[9]. Few researches have been done on the academics population so it is important to identify the factors that increase work satisfaction. Kanter (1977) noted that employees who access to power from information, support, resources and opportunities become more creative and innovative and they can carry out job activities effectively. She believed that when these organizational characteristics are present, employees are more satisfied with their work [10]. Kanter's (1977) theory of structural empowerment is a good framework to explain concepts related to workplace behaviors, such as turnover, job satisfaction, and organizational commitment. In other hand, the multidimensional role of lecturers in universities caused role conflict and role overload.

Role conflict and work over load may result on job satisfaction especially when the structural empowerment is not in place. Employees are more satisfied when they have access to resources and support, information, opportunities, Changes to the research universities occurred in a rapid pace. Therefore, Lecturers who experiencing the negative effects of restructuring in educational system may feel greater degrees of job dissatisfaction. Numerous studies have linked empowerment to organizational attitudes and behaviors, such as job satisfaction, job control, organizational justice, Laschinger (2001) found that higher levels of structural empowerment were predictive of higher job satisfaction [11]. The structural perspective focuses on the organizational structure and shared authority and power between superior and subordinate. Kanter found that work environments that provide two components are empowering and enable employees to achieve their work. The first component, opportunity, refers to growth, mobility, and the chance to increase knowledge and skills. The second component, structure of power, refers to the ability to access and mobilize resources, information, and support from one's position in the organization to get the job done successfully [12]. Access to resources refers to the ability to acquire necessary materials, supplies, money, and personnel needed to meet organizational goals. Information relates to the data, technical knowledge, and expertise required performing one's job. Support refers to guidance and feedback received from subordinates, peers, and supervisors to enhance effectiveness.

METHODS

Population and sampling

This study is part of a larger study that examined the empowerment of lecturers in research universities. The sample of 400 lecturers in four research universities in Malaysia was selected based on cluster random sampling. The questionnaire was sent with a covering letter, followed by a reminder letter 2 weeks later. One hundred and ninety four questionnaires (48% return rate) were returned.

Instruments:

Job satisfaction scale measure 9 aspects of job satisfaction, including: pay; promotion; supervision; benefits; contingent rewards; operating procedures; co-workers; nature of work; and communication [13]. Rating scale format with six choices per item ranging from strongly disagrees to strongly agree is changed to 7 likert scale from very strongly disagree to very strongly agree. The Job Satisfaction Survey or JSS has some of its items written in each direction-positive and negative. Scores on each of nine facet subscales, based on 4 items each, can range from 4 to 28; while scores for total job satisfaction, based on the sum of all 36 items, can range from 36 to 252.

Structural Empowerment Scale Conditions for work effectiveness Questionnaire (CWEQ-II), a modified version of the Conditions for Work Effectiveness Questionnaire (CWEQ) was selected. CWEQ-II consists of 19 items that measure the 6 components of structural empowerment described by Kanter (1977) includes opportunity, information, resources, support, ,the Job Activities Scale (JAS) for formal power and the Organizational Relationships Scale (ORS) used to measure informal power, respectively and a 2-item global empowerment scale which is used for construct via validation purposes (Laschinger, Finegan, Shamian, & Wilk, 2001). Scores for total job satisfaction, based on the sum of all 21 items, can range from 21 to 147.

FINDINGS

Mean standard deviation and reliabilities conducted by SPSS program version 15.Table 1 shows reliability analysis done with Cronbach's alpha for all measurement variables. Reliabilities of scale were 0.893 and 0.966 respectively for job satisfaction and structural empowerment scale.

Table 1. Cronbach reliability coefficients for Job satisfaction survey

Instrument	Alpha coefficients
Job satisfaction survey	.893
Conditions for Work Effectiveness Questionnaire	.966

The descriptive analysis of demographic information revealed that the mean age of the lecturers was 42 (SD=7.68). On average, they had 12 (SD=7.60) years of work experience in the current department. The majority was male (50.3%), worked full time (75.6%). (Table 2)

Table 2: Mean, Standard Deviation, Frequency and Percentage of Demographic Information of lecturers

	Frequency	%	Mean	SD
Gender				
male	99	50.3		
female	94	47.7		
Age			42	7.68
Employment status				
Full-time	149	75.6		
Part-time	44	22.3		
Work experience			12	7.60

In order to test the relationship between structural empowerment and job satisfaction, simple regression was done. The result shows the structural empowerment had significant and mediate relationship with psychological empowerment. The

regression analysis of criterion variable of job satisfaction to the predictor variable of structural empowerment is presented in table 3. Structural empowerment was statistically significant contributor to job satisfaction (β =0.498, P<0.01). R^2 for structural empowerment was 0.248 which indicates that 24% of the variability in lecturer job satisfaction was accounted for by structural empowerment.

Table3. Results of simple linear regression, structural empowerment affecting job satisfaction

	β	R^2	P
Structural empowerment	0.498	0.248	0.000

To examine the correlation between each dimension of structural empowerment and overall job satisfaction Pearson correlation analysis was done. The results shows that there significant relationship between access to information, support, resources, opportunity, formal and informal power with lecturers' job satisfaction. (see table 4)

Table 4. Correlation between structural empowerment subscale and overall job satisfaction

variable	Job satisfaction
Structural empowerment	
Opportunity	o.275**
Information	0.459**
Resources	0.414**
Support	0.346**
Formal power	0.456**
Informal power	0.401**

** Correlation is significant at the level 0.01

CONCLUSION

The results of this study support the contribution of lecturers' structural empowerment on their job satisfaction. Results of The study meanwhile reveal that there is correlation between six dimension of structural empowerment and overall job satisfaction. The strongest relationship is between information and job satisfaction. This finding dominates the importance of the impact that access to information has on lecturers' satisfaction on their career. This is the responsibility of administrative in research universities to share accurate information in context of educational organizations the relationship between job satisfaction and support and opportunity were somewhat lower but significant. The significant contribution structural empowerment has on job satisfaction are consistent with expectation of Kanter's theory and previous researches. Lecturers like the staff in other organizations feel they are more satisfied in their job as a lecturer, when they have sufficient access to support, information, resources, and opportunity, formal and informal power.

REFERENCES

[1] Mountjoy, M. S. *faculty perception of empowerment in private four-year colleges*. University of Missouri-Columbia. (2001).

[2] Salmi, J. the challenge of establishing world-class universities. In (pp. 96): the world bank publication. (2009).

[3] Aziz, K. what is research university? (2006).

[4] Conger, J. A., & Kanungo, R. N. The empowerment process: integration theory and practice. *Academy of Management Review,* (1988). *13*(3), 471-482.

[5] Teichler, U. (2007). Germany and Beyond: New Dynamics for the Academic Profession. *International Centre for Higher Education Research Kassel*.

[6] Laschinger, H. K. S., Purdy, N., & Almost, J. The Impact of Leader-Member Exchange Quality, Empowerment, and Core Self-evaluation on Nurse Manager's Job Satisfaction. *Journal of nursing administration,* (2007). *37*(5), 221-229.

[7] Davies, M.-A., Laschinger, H. K. S., & Andrusyszyn, M.-A. Clinical Educators' Empowerment, Job Tension, and Job Satisfaction A Test of Kanter's Theory. *journal for nurses in staff development*(2006). *22*(2), 78-86.

[8] Hung, C.-J. *A correlational study between junior high school teacher empowerment and job satisfaction in Kaohsiung area of Taiwan (China)*. university of the incarnate word. (2005).

[9] Spreitzer, G. M., Kizilos, M. A., & Nason, S. W. A Dimensional Analysis of the Relationship between Psychological Empowerment and Effectiveness Satisfaction, and Strain. *Journal of Management,* (1997)., *23*(5), 679-704.

[10] Kanter, R. M. *Men and women of the corporation*. New York: basic books. (1977).

[11] Laschinger, H. K. S., Finegan, J., Shamian, J., & Wilk, P. Impact of structural and psychological empowerment on job strain in nursing work settings: Expanding Kanter's Model. *Journal of Nursing Administration,* (2001). *31*(5), 260-272.

[12] Spector, P. E. *Job satisfaction: Application, assessment, causes, and consequences*. Thousand Oaks, C.A.: Sage. (1997).

Investigating Social Responsibility of World's Largest Steel Producing Companies

Mehran Nejati[1,*], Sasan Ghasemi[2]
[1] School of Management, Universiti Sains Malaysia (USM), Malaysia
[2] ALA Excellence Consulting Group, Isfahan, Iran
* Mehran.Nejati@gmail.com

Abstract
In this paper, social responsibility and responsible business behaviours of world's five largest steel-producing companies namely ArcelorMittal (Global), Baosteel Group (China), POSCO (South Korea), Nippon Steel (Japan) and JFE (Japan) are reviewed and assessed. Through investigating the 2009 CSR reports of these companies, major CSR elements of their reports as well as the differences among companies are identified and illustrated.

Keywords
Social Responsibility, CSR, Social Reporting, Steel Industry

INTRODUCTION

Other than contributing to economic development and well-being of society and being accountable toward shareholders, companies are nowadays required to be responsible toward a wider group of stakeholders which includes society, customers, employees, environment, government, shareholders, etc. In other words, companies should be accountable to profit, planet and people which, in the long run, leads to sustainability of the company. Manufacturing companies which take use of available resources will affect their surroundings to a noticeable level and are therefore required by general public to return back to society. This is why corporate social responsibility (CSR) which is also known as Responsible Business Behaviours has gained increasing momentum in the current century. Over the last few decades, corporate social responsibility has also gained increasing attention in academic literature (de Bakker et al., 2005) with more and more publications in this area and significant increase in the number of organisations which engage in social behaviours and activities (McIntosh et al., 2003; McWilliams et al., 2006; Stainer & Stainer, 2003).
In line with this growing interest in CSR, companies communicate their responsible business behaviours through annual CSR reports to gain competitive advantage and build trust among their stakeholders.

This study will investigate the status of CSR practices in steel producing industry by reviewing the 2009 CSR annual reports of top 5 largest steel producing companies namely ArcelorMittal (Global), Baosteel Group (China), POSCO (South Korea), Nippon Steel (Japan) and JFE (Japan).

SOCIAL RESPONSIBILITY

According to European Commission (2001) being socially responsible means not only fulfilling legal expectations, but also going beyond compliance and investing more into human capital, the environment and relations with stakeholders. Furthermore, as stated by World Commission on Environment and Development (World Commission on Environment and Development, 1987, p.43):

> "CSR is the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local community and society at large" (World Business Council for Sustainable Development, 1999).

As defined by business in the community (BITC), corporate (social) responsibility as "…the management of a company's positive impact on society and the environment through its operations, products or services and through its interaction with key stakeholders such as employees, customers, investors and suppliers" (Business in the Community, 2005).
CSR should focus on those who directly or indirectly affect or are affected by corporate activities (Donaldson & Preston, 1995; Jones, 1995; Wood & Jones, 1995). In general, CSR insists that corporations should not only be responsible to their shareholders, but since they are operating within society they should therefore have responsibilities toward society as a whole.
There is a growing interest in social reporting. For example a 2001-benchmark survey of the state of global environmental and social reporting revealed that over 65 percent of the world's largest 100 companies engaged in some form of internet reporting of CSR issues (Line et al., 2002).

CASE COMPANIES

ArcelorMittal

Being the largest steel producing company in the world formed in 2006 by the merger of Arcelor and Mittal Steel, ArcelorMittal is a global steel

company headquartered in Luxembourg. Its products include steel, flat steel products, long steel products, stainless steel, wire products, and plates. With an operating income of over 1.6 billion USD in 2009, the company employed over 281,000 employees in 2009 (ArcelorMittal Annual Report, 2009).

Baosteel Group

Being the largest Chinese iron and steel conglomerate in China, Baosteel is headquartered in Shanghai (China). With a revenue of over 21 billion USD in 2009, the company employed over 108,000 employees in 2009.

POSCO

The Pohang Iron and Steel Company (POSCO) is the world's second largest steel maker by market value (Bloomberg, 2009) and Asia's most profitable steelmaker (Bloomberg, 2010). It is based in Pohang (South Korea) and had an operating income of over 3.8 trillion Korean Won in 2009. The company employed over 29,000 employees in 2009.

Nippon Steel

Nippon Steel Corporation, also known as Shinnittetsu, was founded in 1970. Being among the most profitable steel companies in the world, the company employed a number of over 50,000 employees in 2009. Company's products include steel and chemicals.

JFE

Founded in 2002 by the merger of NKK and Kawasaki Steel Corporation, JFE Holdings, Inc. is mainly involved in steel production besides engaging in engineering, construction, logistics, and chemicals. The company is headquartered in Tokyo (Japan) while operating several overseas subsidiaries in the United States, China and Brazil. The company had a total operating income of over 407 billion Yen in 2009.

METHODOLOGY

This study was conducted using secondary data. The required data was collected from published company annual CSR reports, which were downloaded from the companies' websites. The year 2009 was chosen as the most recent annual CSR reports available for all companies were for that year.

This study used direct observation of the company's annual CSR report to analyze and examine their responsible business behaviours.

EMPIRICAL STUDY

Social Responsibility

ArcelorMittal

Responsible business behaviours of ArcelorMittal mainly included transparency, partnership for education in South Africa, energy management, work safety and health, engagement with NGOs, environmental practices, completion of the reconstruction work of a primary school in China, launching International Scientific Network in Physical Metallurgy, signing an agreement with the European Metalworkers' Federation to ensure competitiveness and long-term sustainability, as well as voluntary community engagement and activities such as reforestation and cleaning of local parks, blood donation and rehabilitation of local schools, orphanages and sports facilities.

Baosteel Group

Baosteel's corporate social responsibility strategy focuses on economy (by emphasizing sustained innovation and green operation), environment (by upholding concepts of environmental friendliness and ecological civilization), society (by reaching goal of society rewarding, harmony and win-win result) and employee (by creating atmosphere of happy work and joint efforts for future development).

POSCO

Responsible business behaviours of POSCO included stakeholder engagement, sustainability management, fair competition activities, risk management, environmental and green business activities, health and safety, social contributions and community engagement.

Nippon Steel

A summary of key CSR activities of Nippon Steel includes stakeholder engagement, voluntary activities, revolutionary technology development for the prevention of global warming, steelmaking processes contributing to the recycling of resources, environmental preservation, and biodiversity activities.

JFE

Main responsible business behaviours of JFE cover activities related to preventing global warming, preserving environment, R&D of environmental conservation technology, restoring marine environments, and recycling technology supporting a sustainable society.

Social Reporting

Table 1 shows the main sections included in the CSR reports of studies companies.

Table 1. Sections Included in CSR Report (Based on 2009 reports)

	Arcelor Mittal	Baosteel	POSCO	Nippon	JFE
Chairman and CEO's overview	✔	✔	✔	✔	✔
Company Profile	-	✔	✔	✔	-
Strategy and performance	✔	✔	✔	✔	-
Corporate responsibility management and governance	✔	✔	✔	✔	✔
Stakeholder engagement	✔	✔	✔	✔	✔
Responsible business behaviours	✔	✔	✔	✔	✔

✔ : covered

Figure 1 shows the areas covered in the social responsibility reports of the world leading steel producers.

Figure 1. Social Responsibility Elements in CSR Reports of Studied Steel Producing Companies (Based on 2009 reports)

Table 2 summarizes the details of the CSR reports of the studied companies and indicates some observed differences among companies.

Table 2. Details of CSR Reporting (Based on 2009 reports)

	Arcelor Mittal	Baosteel	POSCO	Nippon	JFE
CSR Report	✔	✔	✔	✔	✔
Length (page)	45	76	74	53	42
Attention to Global Warming/ Climate Change	✔	✔	✔	✔	✔

Reporting Standards

While the 2009 CSR report of ArcelorMittal was compatible with United Nations Global Compact Principles and the Global Reporting Initiative (GRI), the social responsibility report of POSCO was in line with international verification standard (AA1000AS). Furthermore the report by Baosteel Group was compiled in accordance with the Guidelines for Social Responsibility Performance by Central Enterprises, the Sustainability Reporting Guidelines (G3version) of the Global Reporting Initiative (GRI), the 10 principles of the United Nations Global Compact, the Guidelines of the Chinese Academy of Social Sciences for the Compilation of Social Responsibility Reports by Chinese Enterprises, and Baosteel's practical conditions.

Furthermore, Nippon Steel applied GRI "Sustainability Reporting Guidelines Version 3.0." and "Environmental Reporting Guidelines" of the Japan Ministry of the Environment as guidelines for preparing their CSR report. Besides, JFE's CSR report was prepared in accordance with the "Guidelines for Environmental Reports (FY 2007 edition)" issued by Japan's Ministry of the Environment and "Sustainability Reporting Guidelines 2006."

CONCLUSION

This study showed that world leading steel producing companies are ware of their social responsibilities and communicate their responsible business behaviours through specified annual CSR reports. All the studied companies engaged with their stakeholders and perceived stakeholders essential to their competitive sustained advantage and survival.

While the length of the CSR report provided by the studied companies differ, with Chinese and South Korean companies longer than others, the content of all reports are relatively the same. Various previous studies have investigated the effect of different factors such as economic factors, institutional differences and board of directors on the extent of the corporate governance statement (e.g. Amran et al., 2010; Bauwhede and Willekens, 2008). Furthermore, all reports mainly follow GRI as the main guideline for preparing their annual CSR report. Following similar standards of reporting would make it easier for stakeholders as well as researchers to analyze the report and make comparisons among companies.

ACKNOWLEDGEMENT

The first author would like to thank Universiti Sains Malaysia (USM) and specifically Institute of Postgraduate Studies (IPS) for providing Vice-Chancellor Award and supporting the presentation of this paper in the 4th International Conference on

Postgraduate Education.

REFERENCES

[1] ArcelorMittal Annual Report (2009). *ArcelorMittal 2009 Annual Report.* http://www.arcelormittal.com/rls/data/upl/638-17-0-ArcelorMittalAnnualReport2009.pdf. Retrieved 2010-10-15.

[2] Amran, A., Ishak, M. S., Zulkafli, A. H., & Nejati, M. (2010). Board Structure and Extent of Corporate Governance Statement. *International Journal of Managerial and Financial Accounting*, 2(4), 383-400.

[3] Bauwhede, H.V., & Willekens, M. (2008). Disclosure on corporate governance in European Union. *Corporate Governance: An International Review*, 16(2), 102–115.

[4] Bloomberg (2009). *Korean Won, Stocks, Bonds Slump as Global Recession Deepens*. Available at: http://www.bloomberg.com/apps/news?pid=newsarchive&sid=ae5qz21hHvhM (accessed 16 October, 2010).

[5] Bloomberg (2010). *India Seeks to Lift Posco Hurdles as President Lee Visits Delhi*. Available at: http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aJSimfdFYWQQ (accessed 16 October, 2010).

[6] Business in the Community (2005), available at: www.bitc.org.uk/resources/jargon_buster/cr.html (accessed 16 October, 2010).

[7] de Bakker, F. G. A., Groenewegen, P., & den Hond, F. (2005). A bibliometric analysis of 30 years of research and theory on corporate social responsibility and corporate social performance. *Business and Society Review*, 44(3), 283-317.

[8] Donaldson, T., & Preston, L.E. (1995). The stakeholder theory of the corporation: concepts, evidence, and implications. *Academy of Management Review*, 20, 65-91.

[9] European Commission (2001). Promoting a European Framework for Corporate Social Responsibility. *EU Green Paper*, Brussels: Commission of the European Communities.

[10] Jones, T. M. (1995). Instrumental Stakeholder Theory: A Synthesis of Ethics and Economics. *Academy of Management Review*, 20(2), 404-437.

[11] Line, M., Hawley, H., & Krut, R. (2002). The development of global environmental and social reporting. *Corporate Environmental Strategy*, 9(1), 69-78.

[12] McIntosh, M. R., Leipziger, T. D., & Coleman, G. (2003). *Living corporate citizenship. Strategic routes to socially responsible business*. London: Prentice-Hall.

[13] McWilliams, A., Siegel, D. S., & Wright, P. M. (2006). Introduction-Corporate social responsibility: Strategic implications. *Journal of Management Studies*, 26(1), 1-18.

[14] Stainer, A., & Stainer, L. (2003). Editorial: Business performance and corporate social responsibility. *International Journal of Business Performance Management*, 5(2/3), 107-108.

[15] Wood, D.J., & Jones, R.E. (1995). Stakeholder mismatching: a theoretical problem in empirical research on corporate social performance. *The International Journal of Organizational Analysis*, 3(3), 229-267.

[16] World Business Council for Sustainable Development (1999). *Corporate Social Responsibility. Meeting Changing Expectations*, Conches-Geneva.

[17] World Commission on Environment and Development (1987). *Our Common Future*. Oxford: Oxford University Press.

Brand Origin Recognition Accuracy (BORA) Score and It's Consequences

Poh-Chuin, Teo[1,*] and Osman Mohamad[2]
[1]School of Management, Universiti Sains Malaysia
[2] Graduate School of Business, Universiti Sains Malaysia
*pohchuin@gmail.com

Abstract
This paper seeks to measure young Malaysians' abilities in recognizing brands' countries of origin, where their brand origin recognition accuracy (BORA score will be calculated. Besides, this study also aims to examine the significant differences between consumers with high and low BORA score on their preferences towards different product categories-countries of origin associations. The data collection method is self-administered survey and the data collection method is convenience sampling. SPSS version 17 is the data analysis tool. The findings of this study showed that young Malaysians presented relatively low ability in recognizing brands' countries of origin. Moreover, high and low BORA consumers presented significant differences on their preferences towards different product categories-countries of origin associations. Research implications to policy makers and marketing practitioners are discussed. Research limitations and recommendations for future researchers are also presented.

Keywords
Brand Origin Recognition Accuracy (BORA), Consumer Ethnocentrism, Consumer Animosity, Young Malaysian, Product Categories-Countries of Origin Associations' Preferences

INTRODUCTION

Brand's country of origin is the mainstream of research in the fields of international marketing and consumer behavior (Usunier, 2006). Nonetheless, there is an argument that is paradoxical with the implicit assumption in country of origin literature, where consumers have limited knowledge of brand's country of origin and it probably is not vital to consumers (Samiee et al., 2005). Subsequently, brand origin recognition accuracy (hereinafter called BORA), was proposed, conceptualized, measured and tested by Samiee et al. (2005). They further pointed out that the research on BORA is vital on the implementation of standardized international marketing programs, the importance of incorporating brand origin in product associations, and the inflation of the importance and impact of brand origin on consumer behavior in experimental research. This study seeks to test the concept of BORA in Malaysia context.

LITERATURE REVIEW

Country of origin is one of the most fruitful research area in marketing (Laroche et al., 2001), while the study of BORA is based on it. Indeed, recently researchers highlighted the real-world relevancy of the research of country of origin, where previous researchers overwhelming the importance of it's in influencing the purchase decision of industrial buyers and consumers (Samiee et al., 2005; Usunier, 2006).

For example, Kang and Yang (2010) conducted a study in United America and found the country reputation of South Korea strongly affected attitude and purchase intentions of Americans towards South Korean products. Additionally, the overall corporate reputations of South Korea played more significant impacts. However, this study overwhelming the importance of the cue of country of origin, where the country reputation and the overall corporate reputations of South Korea were used as the only cues in examining respondents' attitude and purchase intention. It is believed that the results might be different if other cues, both intrinsic cue (design, quality, size and etc.) and extrinsic cue (packaging, warranty and guarantee and etc.) were incorporated in their study. In other words, country of origin might not present significant impact on consumer attitude and purchase decision.

There are some efforts that examine consumers' abilities in recognizing brand's country of origin that done by previous researchers, such as Paswan and Sharma (2004), Samiee et al. (2005) and Jin et al. (2006). The results of their studies showed that consumers in different countries presented different abilities in recognizing brand's country of origin. The findings of Paswan and Sharma's (2004) and Jin et al.'s (2006) studies demonstrated that Indian consumers have high knowledge about brands' countries of origin; whereas the study of Samiee et al. (2005) found Americans just posed relative low ability in recognizing brands' countries of origin.

Based on the discussion above, this study aimed to examine young Malaysians' abilities in recognizing brands' countries of origin and the consequences of its. It is believed that consumers with different level of knowledge about brands' countries of origin displayed different level of sensitivity towards this information. Moreover, different countries posed

distinctive images in consumers' minds with specific product categories, such as Italian shoes and France fashion apparels. Therefore, it is posited that consumers with different BORA level presented significant different preferences towards different product categories-countries of origin associations.

METHODOLOGY

The population of this study is young Malaysians and the sample is young Malaysians aged 16 to 30 years old, as previous studies categorized the consumers in and within this age range as young consumers (e.g., Hensen, 2008; Goi, 2009). The data collection method is self-administered survey. The sampling technique is convenience sampling, where this sampling method is the most popular in the research on country of origin (Roth & Diamantopoulos, 2008). A total of 350 questionnaires were distributed in Pulau Pinang, as Pulau Pinang attracted workers and students from other states of Malaysia (National Higher Education Research Institute, 2010; Penang State Tourism, 2010). A total of 345 questionnaires were returned, and 318 were usable responses, consists of 90.9%.

A structured questionnaire was designed to collect data. The questionnaire consists three parts. The first part was designed to collect respondents' socio-demographic related information. The second part was designed to measure respondents' abilities in recognizing brands' countries of origin. A total of 31 brands were selected based on the five considerations proposed by Samiee et al. (2005). These brands were identified from market brands' list that accessed from Global Market Information Databases. There are a total of 16 local brands and 15 foreign brands. 'Not listed' and 'Don't know' were employed as additional options to test the possibility of guessing as suggested by Samiee et al. (2005). Besides, BORA score ranging from zero to 100%, where 100% indicates full knowledge about brand's countries of origin while zero implies respondents have no knowledge about that. Lastly, the third part of the questionnaire was designed to capture respondents' preferences towards different product categories-countries of origin associations. A 5-point Likert scale ranging from 1=least preferred to 5=most preferred was used to measure respondents' preferences.

ANALYSIS AND FINDINGS

First, frequency analysis was undertaken to measure the socio-demographic background of respondents. The results are presented in Table 1. Most of the respondents aged 21-25 (211 respondents), followed by 16 to 20 and 26-30 years old, which are 58 and 49 respondents, respectively. Majority are female (188 respondents) and single (287 respondents). In terms of ethnicity, there are 124 Chinese, 103 Malays and 91 Indians. A total of 155 of them are bachelor's degree holders, followed by master/PhD, Diploma, SPM/MCE and STPM/HSC, which are 61, 47, 35 and 19 respondents, accordingly.

Next, descriptive analysis was run to measure respondents BORA score. The results are presented in Table 2. There are two steps in calculating BORA score. Firstly, calculate the number of correct BORA. Secondly, calculate BORA score, which is:

(The number of correct Overall BORA/31) x 100%

The results of analysis shown that young Malaysians presented relatively low ability in recognizing brands' countries of origin, which is 23.32% and the standard deviation is 13.10.

Table 1 Sample profile

Socio-demographic	Categories	Frequency (n=318)	Percentage (%)
Age	16-20	58	18.2
	21-25	211	66.4
	26-30	49	15.4
Gender	Male	130	40.9
	Female	188	59.1
Ethnic	Malay	103	32.4
	Chinese	124	39.0
	Indian	91	28.6
Marital status	Single	287	90.3
	Married	31	9.7
Education	SPM/MCE	47	14.8
	STPM/HSC	19	6.0
	Diploma	35	11.0
	Bachelor's degree	155	49.1
	Master/PhD	61	19.2

Table 2 Mean and standard deviation of BORA score

Variable	Mean (%)	Standard deviation
Overall BORA score	23.31	13.10

Note: Score ranged from zero to 100%

Lastly, independent *t*-test was undertaken to test the influences of BORA score on consumers' preferences towards different product categories-brands' COO associations. Respondents were classified into high BORA and low BORA groups based on the medium value BORA score, which is 22.58%. The results of analysis are presented in Table 3.

Significant results were found on fashion apparels-Singapore and chocolate/confectionary's product-Holland associations. High and low BORA groups

displayed significant differences on their preferences towards these associations, where the t-value is 2.05 and -2.08. Low BORA groups presented significantly high preferences towards the former associations as compared to high BORA group, where the mean values are 3.21 and 2.95, respectively. In contrast, high BORA group displayed significantly high preferences towards the latter association where the mean value is 3.55, as compared to low BORA group (mean value= 3.24).

In terms of fashion apparels and textiles, respondents tended to showed highest preferences towards brands from the US, followed by Malaysia, while they showed lowest preferences towards brands from Singapore and Holland. Similar results were found in the case of electrical goods and appliances. Nevertheless, they tended to displayed highest preferences towards chocolate/confectionary's brands from the US, followed by Holland, Malaysia and Singapore.

Table 3 BORA and preferences towards different product categories-brands' COO associations

Brand origins and product categories	Preference (mean value)		t-value
	Low BORA group	High BORA group	
Fashion (apparels and textiles)			
US	3.36 (1)	3.61 (1)	-1.77
Malaysia	3.30 (2)	3.26 (2)	.27
Singapore	3.21 (3)	2.95 (4)	**2.05***
Holland	2.98 (4)	2.97 (3)	.07
Electrical goods and appliances			
US	3.43 (1)	3.64 (1)	-1.46
Malaysia	3.30 (2)	3.31 (2)	-.06
Singapore	3.07 (3)	3.01 (4)	.43
Holland	2.94 (4)	3.07 (3)	-.95
Chocolate/confectionary's product			
US	3.60 (1)	3.71 (1)	-.72
Holland	3.24 (2)	3.55 (2)	**-2.08***
Malaysia	3.11 (3)	3.26 (3)	-1.01
Singapore	3.03 (4)	2.84 (4)	1.38

Note: 5-point scale ranged from 1=least preferred to 5=most preferred; * $p < 0.05$

DISCUSSIONS AND IMPLICATIONS

Results of analysis revealed that young Malaysian's BORA score is relatively low, as compared to the studies that done in the US that conducted by Samiee et al. (2005) and India that undertaken by Jin et al. (2006). The samples of the former study were American aged 18 to 65 years old, while the samples of the latter study were postgraduate students. Empirical evidence has been proven that higher educated consumers presented higher BORA score (Samiee et al., 2005).

Marketing practitioners are encouraged to measure consumers' abilities in recognizing the country of origin of their brand, before designing marketing strategies and communications. If consumers are aware about the brand's country of origin, then marketers for brand with favorable origin image are encouraged to utilize and incorporate the brand's country of origin information in their marketing strategies and vice versa.

In addition, young Malaysians with different BORA level presented significant differences towards different product categories-countries of origin associations. Generally, high BORA group presented more favorable preferences towards brands from the US than low BORA group; while low BORA group showed more positive preferences towards Singaporean brands as compared to high BORA group in all product categories. However, their preferences towards brands from Malaysia and Holland are based on product categories, where high BORA group displayed more favorable preferences towards Malaysian brands, in terms of electrical goods and appliances as well as chocolate/confectionary's product, but opposite on fashion apparels and textiles.

These results bring some insights to policy makers and marketing practitioners. Policy makers are encouraged to incorporate the information about Malaysians' BORA score and their preferences towards different product categories-countries of origin associations in campaigns, such as Buy Malaysian Campaign, in order to make the campaign success. Similarly, marketing practitioners are supported to incorporate these information in their international marketing strategies and communications, in order to build favorable brand image as well as greater brand equity.

Limitations and future recommendations

This study limited by the scope of study, which is the consequence of BORA score. This study only focused on respondents' preferences towards certain product categories and countries of origin. Future researchers are encouraged to expand this study by examining

other products categories and origin countries. Moreover, the focus of this study is young consumers only. Thus, future researchers are recommended to examine others segment, based on different segmentation such as usage segmentation and geographical segmentation.

ACKNOWLEDGMENTS

Grateful acknowledgment is made for the sponsor and support by Institute of Postgraduate Studies, Universiti Sains Malaysia.

REFERENCES

[1] C.L. Goi, "Integrated marketing communications: perception of young consumers", (2009) [Online]. [Accessed 13th July 2009] Available from World Wide Web: http://66.102.1.104/scholar?q=cache:yH8B1IJZidEJ:scholar.google.com/+young+consumer,+chai+lee+goi&hl=en

[2] C.A. Hensen, "An analysis of the coffee service industry in metro Manila and the buying behavior of its consumers", *Loyola Schools Review*, VI (2008) 47-78.

[3] Z. Jin, B. Chansarkar, N.M. Kondap, "Brand origin in an emerging market: perceptions of Indian consumers", *Asia Pacific Journal of Marketing and Logistics*, 18 (2006) 283-302.

[4] M. Laroche, J. Bergeron, G. Barbaro-Forleo, "Targeting consumers who are willing to pay more for environmentally friendly products", *Journal of Consumer Marketing,* 18 (2001) 503-520.

[5] M. Kang, S-U. Yang, "Comparing effects of country reputation and the overall corporate reputations of a country on international consumers' product attitudes and purchase intentions", *Corporate Reputation Review*, 13 (2010) 52-62.

[6] A.K. Paswan, D. Sharma, "Brand-country of origin (COO) knowledge and COO image: investigation in an emerging franchise market", *Journal of product & Brand Management*, 13 (2004) 144-155.

[7] K.P. Roth, A. Diamantopoulos, "Advancing the country image construct", *Journal of Business Research*, 62(2008) 726-740.

[8] S. Samiee, T.A. Shimp, S. Sharma, "Brand origin recognition accuracy: its antecedents and consumers' cognitive limitations", *Journal of International Business Studies*, 36 (2005) 379-397.

[9] J-C. Usunier, "Relevance in business research: in the case of country-of-origin research in marketing", *European Management Review*, 3 (2006) 60-73.

The Effect of Internal Marketing on Airline Business Performance: Empirical Evidence from Low Cost Carrier Industry

Yudi Fernando*, Norizan Mat Saad, and Mahmod Sabri Haron
School of Management Universiti Sains Malaysia 11800 Pulau Pinang[1,2,3]
*yudhitjoa@gmail.com

Abstract
The purpose of this paper is to investigate the relationship between internal marketing (IM) and airline business performance (ABP) in a low cost carrier industry. Besides, several attempts have been made to validate the extension of IM and ABP model. Data were collected from mixed method. Firstly, it is a qualitative method. The benchmarking study has been conducted and uses the secondary data which drawn from published annual reports on top-two best LCC practices in the six regions of the world. Second, quantitative analysis was used to verify the validity and reliability of IM and ABP constructs. Survey data measuring constructs and hypothesis testing were collected from the 209 low cost carrier managers in five large cities in Indonesia. Results reveals that empowerment is fit as part of IM constructs and the three factors solution appeared to be the latest dimensions of ABP. The paper also extends the IM and ABP model and contributes to the scarce body of empirical linked between IM and ABP in services organizations.

Keywords
Budget airline, mixed method, airline performance

INTRODUCTION

Airline service process is complex compare to other service industries. An airline will not be able to compete with its competitors in the market if it is still doing high investment and other higher operational cost. Most of airlines services provide similar products and the differences only could be seen at the employees. Indeed, airline process is linked with employee capability.The increasing of recognition of the importance of the employees' role in the service industry has led the organizations to adopt the IM concept (9). In order to keep the competition and deliver reliable service, IM needs to be implemented (4).

LITERATURE REVIEW

To achieve the organization's objective in delivering excellence service, service organization requires many staff which can be flexible and have scope to use their discretion in meeting customer demands (2). IM leads to satisfy and motivate employee to deliver better service. Further, IM also give sense of belonging to the organization and keep them to work more productive. The real problem of service organization lies on human recourse (6).

Empowerment needs to be included in IM construct. It has a positive impact on employee's performance (2). Empowering employees also gives space of creativity to solve the service failure during the service encounter. This is a treatment of service recovery to save the organization's face among customers. Empowerment has been suggested accomplishing the IM previous measurement by Ahmed et al. (1).

According to Lovelock (7) the most fundamental difference between a good and a service is that a good is an object and a service is a performance. The superior service quality that delivers to the customer leads to a greater level of BP. However, Ahmed et al. (1) found that the significant linear relationship between IM combined elements and BP.

Hypothesis

H.1: There is a positive and significant relationship between IM and ABP

METHODOLOGY

Qualitative

However, to get more exposures on ABP measurements, the benchmarking study has been conducted. The benchmarking process in a study uses the secondary data which drawn from published annual reports (period 2005-2009). The worldwide best low cost carrier practice used the set of airlines sampled form Skytrax survey results. It was the top-two best low cost airlines in regions. The regions include Europe, Asia, Africa, Australia-Pacific, Middle East, North America and South America. The airlines are ranked by Skytrax, the World's Best Low-Cost Airline survey results in 2007(10).

The researchers identify the words and phrases that are important in the ABP. The words or phrases were selected through the units of interest by categorizing and analyzing the results from the annual report. It was a process called content analysis. Clarke (3) analyzed the communications content of the

chairmen's statements in the annual reports. The sample of his study is on investment companies quoted on the London Stock Exchange. The content analysis is an unobtrusive observational technique. This is to evaluate systematically the symbolic content of these messages in the context of the commercial environment in which they were sent and received (3).

Quantitative

The top five LCC airlines in Indonesia composed the population studied in this research. The study had conducted surveys in top five cities in Indonesia. The cities which would participate in this study were Jakarta, Surabaya, Denpasar, Makassar, and Medan.

An instrument was developed from the literature review, results of benchmarking, and expert review (academician & practitioner). Each item was measured using a seven-point Likert scale. At the time, the draft was completed and effort was made to conduct pre-testing the questionnaire. Questionnaires were prepared in English then translated into national language which where the country was conducting. Bahasa Indonesia is an official language in Indonesia.

The top five LCC airlines in Indonesia composed the population studied in this research. The cities which would participate in this study were Jakarta, Surabaya, Denpasar, Makassar, and Medan. After conducted observation and learnt the Indonesian LCCs organization structure, an average total five cross sectional manager was identified. The estimated population in this research was approximately a 50 (10 x 5) managers and assistant managers of LCC in top five biggest cities of Indonesia. The totals of 500 (10 x 5 x 10) respondents were identified from five LCC head of departments. The quantitative data would be collected through questionnaire. The questionnaires were attached through mail survey technique. Two control variables are included in this study those are: type of flight and ownership. Data were processed and analyzed by SPSS 16.

RESULTS

Qualitative

The aim of benchmarking is to continue the analysis of success strategies of best practice in similar industry. It was examined the ABP into three categories. This category was gained from the top ten of worldwide low cost BP annual report. The first is operation performance (OP). The Passenger load factor is found the highest rate that consists of 8.73 percent. The second one is the financial performance (FP). The FP has represented of 7.14 percent of total performance measurement. The FP is dominating the performance measurement. The last one goes to marketing performance (MP) that found brand awareness in the number of 4.76% and 3, 97% for the number of destination as measurement. After conducted qualitative study, the hypothesis has been restated.

Hypothesis

H.1: There is a positive and significant relationship between IM (SR, IC, TD, SL, EM) and ABP (OP, FP, MP)

Quantitative

Based on the qualitative results the hypotheses were developed (Table 1). The details are provided in Table 1. Totally, there were 914 (500 + 414) sets of questionnaire sent to the respondents, of which 215 were returned for a response rate of 21.5 percent. There were six returned questionnaires rejected due to significant omissions. However, there were only 209 sets of questionnaire usable for the analysis. This condition gave an effective overall response rate of 20.9 percent. This response rate was obtained after second mailing, reminders, follow-up calls, and emails were made after the initial mailing.

Two separated factors analyses with varimax rotation were done to validate whether the respondents perceived the predictor and criterion variables which were distinct constructs. The lowest registering reliability value is 0.78 (marketing performance) and the highest is 0.92 (internal communication & senior leadership).

Most of LCC manager has less than five years experience (64.1%) with airline industry, whereas 6-10 years (25.8%), 11-15 years (5.3%), and more than 15 years experiences (4.8%). Management is preferred to employ manager in age range between 25 to 30 years old (34.4%), whereas 31 to 35 years old manager (25.4%), 36 to 40 years old manager (24.4%) and only 15.8 percent of managers are employed in age less than 25 years old.

Table 1. The Multiple Regressions: The Relationship between IM and OP[12]

	OP	
	Model 1 (β)	Model 2 (β)
CV(s):		
CV1 □	.162*	-.033
CV2□	-.086	-.019
PV(s):		
SR		.006
IC		.026

[1] *Note: *p<0.05, **p<0.01, ***p<0.001. CV: Control Variable CV1=Flight Type; CV2= Indonesian ownership; Dummy coded: □ medium and short-haul = 1, medium-haul= 0, short-haul = 0; □ Indonesian owned = 1, Non-Indonesian owned = 0, Joint owned = 0; PV: Predictor Variable; SR= Strategic Rewards; IC= Internal Communication; TD= Training & Development; SL= Senior Leadership; EM=Empowerment; OP= Operational Performance; FP= Financial Performance; MP= Marketing Performance*

[2] *This is applied for model 1, 2 and 3*

TD		.302***
SL		.158*
EM		.334***
R^2	.046	.335
Adjusted R^2	.037	.311
F	4.946**	14.379***

In the first model, the F value of 4.946, which is significant at 0.01, denotes that there is a contribution of control variable into the model (Table 1). The second model displays the findings after the inclusion of predictor variables. The IM was treated as predictor. After statistically controlling the medium and short-haul of flight type and Indonesian ownership, the model improved significantly. The R^2 is 0.335 and followed by the adjusted R^2= 0.311. The R^2 value of 0.335 indicates that control variables and IM can together explain 33.5 percent of the variation in OP.

This model provides evidence of direct positive and significant relationship between IM and OP. The coefficients indicate that the above significant relationship is contributed by three variables, the training & development (β=0.302, p<0.001), senior leadership (β=0.158, p<0.05) and empowerment (β=0.334, p<0.001). The positive sign of beta values shows that there is a significant positive relationship between the training and development, senior leadership and empowerment with OP. Strategic reward and internal communication are non-significant relationship with OP.

Table 2. The Multiple Regressions: The Relationship between IM and FP

	FP	
	Model 1 (β)	Model 2 (β)
CV(s):		
CV1 □	-.070	-.044
CV2□	-.181	-.096
PV(s):		
SR		.319***
IC		.243***
TD		-.117
SL		.058
EM		.039
R^2	.027	.200
Adjusted R^2	.017	.172
F	2.791	7.133***

Table 2 displays the results of the two stages multiple regression of IM to determine their respective impact towards the extent of FP, which is stated in the hypothesis. The additional impact of control variable into Model 1 is not significant as far higher than 5 percent level and only accounted for 2.7 percent of the variance of the extent of airline FP. On the other hand, the additional impact from IM into Model 2 was found to add 20 percent to the total variance of the extent of FP.

This model provides an evidence of direct positive and significant relationship between IM and FP. The coefficients indicate that the above significant relationship was contributed by two variables, the strategic reward (β=0.319, p<0.001), and internal communication (β=0.243, p<0.001). The positive sign of beta values shows that there is a significant positive relationship between the strategic reward, internal communication and financial performance. Therefore, training and development (β=-0.117, p>0.05), senior leadership (β=0.058, p>0.05) and empowerment (β=0.039, p>0.05) are not significant related.

Table 3. The Multiple Regressions: The Relationship between IM and MP

	MP	
	Model 1 (β)	Model 2 (β)
CV(s):		
CV1 □	.062	-.089
CV2□	-.115	-.055
PV(s):		
SR		.215***
IC		.034
TD		.098
SL		.049
EM		.291***
R^2	.023	.187
Adjusted R^2	.014	.158
F	2.428	6.564***

The sub-hypothesis of H.1 investigated the positive relationships between IM and MP. The summary of the results are stated in Table 3. From model 1, it is obvious that there is no direct effect of the control variable on MP. Therefore, model 2 shows that IM have significant contribution to the criterion. The coefficient of determination, R^2 is 18.7 percent and the less than 0.001 significant levels. As for the predictor, only two of the five IM dimensions are found to have a positive influence on MP.

Specifically, strategic reward (β=0.215) and empowerment (β=0.291) are found to have significant and positive relationships with MP at the 0.01 level. Internal communication (β=0.034, p>0.05), training and development (β=0.098, p>0.05), and senior leadership (β=0.049, p>0.05), are not significant related with MP.

DISCUSSION AND CONCLUSION

The previous study revealed that IM has a positive and significant effect on BP (8, 11, 5, & 1). Similarly, the current study also found that IM is significantly related with ABP. This finding shows that IM is becoming successful recipe in managing human's capability and talent. In other words, IM strategy really works, especially in large service organization where quality of service is more depended on human touch. It gives more motivation to do the right things

at the first. IM also focuses on human aspect of the service firm that makes talented employee has no reason to leave the organization. It is suggested to improve financial and non-financial performance (8). IM is empirically tested as a predictor of ABP. Implementing IM will assist low cost airline to sustain in hypercompetitive market.

ACKNOWLEDGMENTS

Grateful acknowledgment is made for fellowship support by Universiti Sains Malaysia.

REFERENCES

[1] Ahmed, P.K., Rafiq, M., Saad, N.M., "Internal marketing and the mediating role of organizational competencies", *European Journal of Marketing*, 37, (2003) 1221-41.

[2] Boshoff, C., Allen, J., The "influence of selected antecedents on frontline staff's perceptions of service recovery performance"*, International Journal of Service Industry Management*, 11, 1 (2000) 63-90.

[3] Clarke, G. "Messages from CEOs: a content analysis approach". *Corporate Communications: An International Journal,* 2, 1 (1997) 31-39.

[4] Fernando, Y., Saad, N. M., Haron, M. S.*,"A Remarkable Flying Experience Began From Internal Services Quality",* International Conference on Management, Hospitality & Tourism, and Accounting, November 12 -13, 2010, Jakarta, Indonesia

[5] Foley, A., Fahy, J. "Seeing market orientation through a capabilities lens", European Journal of Marketing, 43, 1/2 (2009)13-20.

[6] Heskett, J.L., Jones, T.O., Loveman, G.W., Sasser, W.E. Jr., Schlesinger, L. A. "*Putting the Service-Profit Chain to Work (HBR Classic)"*, Harvard Business Review, (2008).

[7] Lovelock, C. H. "Classifying Services to Gain Strategic Marketing Insights". *Journal of Marketing,* 47, 3 (1983) 9-20.

[8] Panigyrakis, G. G., & Theodoridis, P. K., Internal marketing impact on business performance in a retail context, International Journal of Retail & Distribution Management, 37, 7, (2009) 600-628

[9] Papasolomou, I. Can internal marketing be implemented within bureaucratic organisations? *International Journal of Bank Marketing, 24*, 3 (2006) 194-212.

[10] Skytrax. Jetstar Airways scoops the world's Best Low-Cost Airline Award for 2007. Retrieved 25/05, 2008, from http://www.worldairlineawards.com/Awards_2007/Lowcost.htm

[11] Turkoz, I., Akyol, A. Internal Marketing and Hotel Performance. *Anatolia: An International Journal of Tourism and Hospitality Research, 19*, 1 (2008) 149-177.

[12] Rafiq, M., Ahmed, P.K. The scope of internal marketing strategy: defining the boundary between marketing and human resource management, *Journal of Marketing Management,* 9, 3 (1993) 219-32.

Innovation Oriented Constraints between University-industry Technological Collaboration

Abeda Muhammad Iqbal[1], Amat Senin Aslan[2], Adnan Shahid Khan[3], Saima iqbal[4]
[1*2]Faculty of Management and Human Resources, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia
[3]UTM-MIMOS Center of Excellence, Faculty of Electrical Engineering, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia
Priston Institute of Management, Science and Technology,Karachi, Pakistan
[1]abidaiqbal49@yahoo.com, [2]aslan@fppsm.utm.my, [3]adnan.ucit@gmail.com, [4]saimaiqbal_pk@hotmail.com

Abstract
The rapid technological changes and challenges has mad it crucial for corporation to cooperate with institution. It is evident from the study of literature that university-Industry partnership and their consequent knowledge transfer are issues of social, economical, industrial, institutional and political interest. Indeed technological collaboration is a major source of long term economics growth but its transfer to the industries is critical due to a lot of major constraints. The purpose of this paper is to identify the innovational constraints that influence between university-industry collaboration.

INTRODUCTION

To increase rapid growth of incremental innovations and raise the number of radical innovations, university-industry collaborations (UIC) are a powerful means discussed by practitioners as well as by scholars .universities are a critical factor in innovation system of both developed and developing countries (Daniel Schiller, 2008). University research centre is one of the most attractive external source of technology for the industry. Through collaborations, an industry can improve its exploration and exploitation capabilities and consequently improve its innovative and technological capacity.

Innovation oriented Constraints Education and Training

In order for the appropriate technology to be transferred and effectively maintained in the firm of developing country, appropriate educational systems and personnel training must be developed. Singh (1983) emphasises that effective research and development (R&D) activities are influenced by appropriate educational systems. Unless the recipient becomes sufficiently capable of maintaining production systems it has implemented, it will never be able to enhance the capability to modify and improve its technology (Ito, 1986).

Public Policies

Policies should be carefully analysed before the public becomes aware of them (Madu,1992). Both external and internal public policies influence the technology transfer process. Policies such as foreign exchange limitations, trade barriers, high taxes, and indigenization policies, may limit the extent to which technology is transferred.

Negative Perception

The perception that collaboration will threaten traditional academic values. Some faculty members and university administrators are afraid that industrial collaboration will endanger their institutions basic research and graduate training missions (Bollag,1990; Fairweather,1990).Similarly, university researchers are sometimes concerned that engaging in industry-sponsored or applied research will be of no benefit, and possibly hurt, their career (NSB, 1982). The career constraint problem stems from the academic reward structure not placing as much value on research with Industrial or practical relevance.

Conflict of intellectual property

Issues concerning the ownership of the intellectual property rights also create tensions (Cyert and Goodman, 1997). The scientist would want protection of proprietary rights of inventions even before proceeding with the partnership. But the acquisition of such rights may be an expensive, long, and difficult process.

Time Constraint

The industry usually requires solutions to their immediate problems and is not ready to wait until the results of a particular research are available. Any idle time for the industry is translated into lost revenues and therefore should be avoided. There is here a cultural mismatch between the types of research academia are used to and the one the industry has in mind. The corporate world is always concerned about deadlines e.g. delivering in time according to specifications.

CONCLUSION

University-industry research center is one of the most attractive external sources of technology for the industry. Through collaborations, an industry can

improve its innovative and technological capacity. Technology as widely accepted, is essential for improving the economy of a nation, especially in developing countries. To develop the collaboration between university research centers and their collaborated industries some specific constraints has been identified.

ACKNOWLEDGMENT

I would to tender my heartiest appreciation to Dr.Aslan Amat Senin for his contributions, help guidance and also Adnan Shahid Khan for his healthy support for the work.

REFERENCE

[1] Saghafi Nejad, T., , " International technology transfer literature: Advance in theory, Empirical research and policy", in Robinsin, R.D., (Eds.), "the international communication of technology, A Book of Reading", Taylor & Francis, pp.199-223, 1991.

[2] White, E., "Channels and Modalities for the transfer of technology to public enterprises in developing countries", ICEP Monograph series, No. 12,1983

[3] Sanchez, A.M., Tejedor, A.-C.P. University-industry relationships in peripheral regions: the case of aragon in spain. Technovation 15 (10), 613-625, 1995.

The Antecedents of Brand Experience and its Effect on Trust and Resonance: An Empirical Study of Fast Food Industry in Malaysia

Rozita Hj. Naina Mohamed[1], Norzaidi Mohd Daud, Associate Prof.Dr.[2]
Faculty of Business Management, Universiti Technologi MARA (UiTM),
40450 Shah Alam, Selangor Darul Ehsan, MALAYSIA
azarozi_naina@yahoo.com[1], norza544@salam.uitm.edu.my[2]

Abstract
Notably, brand experience is still new and emerging. However, the antecedent's influence of brand experience is still elusive. This study will examined the antecedents influence of customers brand experiences and the consequences of trust on resonance of the four prominent fast food in Malaysia namely , Mc Donald's, Kentucky Fried Chicken, Pizza Hut and Kenny Rogers. Questionnaires will be distributed to 400 respondents using quota sampling. Descriptive analysis will be used to determine the perception of adult's customers and Structural Equation Modeling (SEM) will be utilized to determine the significant levels of associations and interactions between the variables tested. The result of this study will provide insights into the brand experience factors that could influence successful implementation of branding models specifically for the fast food industry and academicians purposes. Indeed, it could also unveil the opportunity for the fast food businesses to reformulate their branding strategies to increase its revenues and earnings thereby ensuring corporate longevity in today's competitive environment

Keywords
Antecedents, Brand Experience, Trust, Resonance, Fast Food Industry.

INTRODUCTION

Delivering a consistent and distinctive customer brand experience has always been central concern of brand management. However, understanding how and why brand experience develops remains one of the key challenging and critical management issues today (Schmitt, 2009). The concept of brand experience captures the very essence of branding much more than analytically and cognitively oriented brand concepts.

ISSUES, STATEMENT OF PROBLEM AND OBJECTIVES

One of the sectors that are affected by the growth of the brand is the fast food industry (Chee, 2008; Rozita, Azaruddin and Asmah, 2008a; 2008b). However, after a few years of the Malaysia government had decided to import the western fast food franchise business, a new issue arises. The issues are on how customers' consumption experience of brand-related stimuli improves brand experience and its effect on customers trust and resonance of brand to survive.

Although the government has been trying to encourage and promote the home-grown fast food industry, it is still at its infancy stage. Due to the high costs of setting up and operating a fast food restaurant, financial strength stands out as an important factor for the long-term survival of these ventures. Therefore, U.S. franchises with proven business systems and track records are encouraged to operate here (9th Malaysian Plan; Agri-Food Trade Service Report, 2007). However, the antecedents influence of brand experience and its effect the fast food sales down should be explore. This refer to an attempt by one or more parties to achieve certain objectives by urging individual consumers to refrain from making selected purchases of brand in the marketplace (Friedman, 1985). There are evident that companies do suffer commercially from brand experience on boycott issue. Shell estimated to have lost between 20 per cent and 50 per cent of their sales during the Brent Spar boycott and the Nestle boycott is said to have cost the firm $40 million (Nestle, 2009). Fewer than 60 percent of the Fortune 1,000 industrial companies and Fortune 500 service companies have in place crisis management plans to respond to a boycott (Liss, 2002). Any systematic response will, therefore, require that the firm redirect significant resources to crisis management activities. Since, local and international fast food operating in Malaysia must adhere to Malaysian commercial and contract laws, procedures, and local norms on halal issues. Kentucky Fried Chicken restaurant at once had been rejected due to slaughter issue of it fried chicken. Fast food typically includes all of the things that nutritionists warn against saturated and transfats, high glysaemic index, high energy density and large proportion sizes (Sherina & Ahmad, 2004). In short, this entire brand experiences phenomenon is about a battle between costs versus benefits. Failure to develop psychological attachment among existing and potential customers may require the business to bear the increased costs associated with managing the brand as an assets that drive every strategic and investments decision (Davis & Dunn, 2002). In view of the high investment in brand and in promoting the international organization to invest their franchise

businesses in Malaysia and its ubiquity, the success of such investments and its effectiveness and efficiency is utmost both for research and in practice.
The question of whether the brand experience could positively affect the consumer's trust and resonance on the brand has always been a debatable issue. It is importance to explore the antecedents of experiences that evoke brand experience (Schmitt, 2009). Consumers experience a brand and whether brand experience are simply an epiphenomenon or whether influence consumer behavior, how to measure brand experience and therefore a need to develop and tested the brand experience model empirically.

LITERATURE REVIEW

Understanding the factors as part of the causes to the success of the strong brand resonance relationship between customer and brand is a central concern in the field of branding (Keller, 2003). Thus, previous studies on customer-brand relationship measures suggested a few number of branding success measures. For instance, (Fournier, 1998) focused on personal relationships and customer satisfaction. These factors, nevertheless, are inconsistencies with their relationships (Garbarino & Johnson, 1999; Sirdeshmukh, Singh, & Sabol, 2002). Therefore, besides (Fournier, 1998) measurement, a number of candidate models were developed. There are several theories of Branding success measures. The most commonly referred theories are Customer-Based Brand Equity Model and Pyramid (CBBEP) (Aaker, 1991; Keller, 2003), Trust-Based Commitment Model (Hess & Story, 2005), Consumption Experience Theory and Consumer Behavior Theory (Holbrook and Hirschman 1982, Brakus et. al., 2009.

The primary purpose of the Aaker (1991) brand equity theory was to synthesize previous research involving branding success into a more coherent body of knowledge and to provide guidance to future researcher Keller (1993). The construct of the model is based on brand awareness, brand association, perceived quality, brand loyalty and other proprietary of assets those measures (i.e price premium, satisfaction, brand personality, market behaviour and etc). Keller (1993) first introduced the customer - based brand equity models which was defined as the" differential effect of brand knowledge on consumer response to the marketing to the brand" and it occurs when consumers are familiar with the brand and hold some "favorable, strong and unique" brand awareness and brand associations in memory. Experiences also occur when consumer consumes and use products.

The consumption experience may be defined as a phenomenon that involves the consumer's subjective evaluation of the cognitive, affective and relational interaction with the items consumed (Schmitt, 1999). Consumption experiences are multidimensional and include hedonic dimensions, such as feelings, fantasies and fun (Holbrook and Hirschman 1982). Schmitt's (1999) experiential marketing concept also adds to the traditional view of the branding concepts. He explicitly states how the brand as an identifier has evolved to become a provider of experience. The experiential marketing approach views brands as an integrated holistic experience, which is possible to create through nurturing sensory, affective and creative relations, as well as associating a lifestyle with the brand. In summary, experiences arise in a variety of settings. Most experiences occur directly during and after the consumption for example when consumers shop, buy and consumer products. Experiences can also occur indirectly where when consumers are exposed to marketing communications such as event, advertising and sales promotion.

Antecedents Influence of Brand Experience

"Experience" is the reality check that sets the limit between what the Brand is saying or promising (antecedents), who the brand is (brand experience), what is the brand is really delivering (trust) and what is the brand achievement (resonance). At this level, customer do not really differentiate between tangible or intangible brand contributions; rational or emotional; what really matters at the end is whether this brand is keeping its promise throughout the experience and making customer's lives better in any form or shape where ideally fulfilling the core Brand Experience based on which customer have decided to deal with it. Therefore, identifying the antecedents influence of brand experience (i.e product quality, service quality, store image, marketing communication) and underlying dimensions of brand experience and develop a dimension that can measure the strength with which a brand evokes each experience dimension are the exact answers to it. One important function of brand names is to give consumers information about product quality. Consequently, the absence of brand names often results in the absence of information about quality. Kotler & Armstrong (2006) define product as anything that can be offered to a market for attention, acquisition, use or consumption that might satisfy a want and need. They further define consumer products as the product bought by the final consumer for personal consumption. Consumers buy products frequently, with careful planning and by comparing brands based on quality, price and style. The lack of information is undesirable for both consumers and sellers: consumers are not able to determine the quality levels associated with different units, sellers have difficulty communicating information about the quality of their products. Product quality can be conceptualized as the meeting or exceeding consumer's expectations whereby if just assumes that conforming to specifications is not adequate.

However, it is also concerned with what the product means to the consumer. Service quality is one of the

most investigated constructs in the history of marketing scholarship and it is clearly the most investigated constructs in the field of services marketing. Zeithaml (2000) recognized as the most comprehensive evaluators of service quality. Even though, the service quality as attitude proposition has not been subjected to much empirical and conceptual debate, the conventional wisdom is that the overall evaluative nature of service quality makes it an attitude or attitude –like constructs (Cronin and Taylor, 1993). The importance of fast food service quality is, in part, driven by research that associates service quality with brand experience. In creating such store image, firms typically establish information cues about the brand. These cues is often semiotic in nature, that is to say, their meanings are embedded in various signs and symbols. Consumer interprets these cues both cognitively and emotionally and from them derive some feeling for the value of the brand experience. The cues act as 'behavior triggering devices" and are integrated into the design, layout, ambience, décor of the brand environment. Research into retailing environments suggest that the following features can affect consumers' purchasing behavior: store image, store layout and music lighting. However, perhaps of greater impact to consumer behavior than these is the store image of the brandscape. In this research context, store image refer to the atmosphere of the restaurant, layout and physical facilities as the main attributes. Store image is subjective feelings that all the aspect of the environment create in the consumer. These subjective feelings derive from the consumer's emotional reaction to the situation which typically idiosyncratic and personal for each consumer. The novelty of the experience may constraint their actions discouraging, them from making purchase. On the other hand it allows them to enjoy the place experience unencumbered on the grounds of the newness of the consumers' 'store image setting'. Marketing communication can be defined by which firms attempt to inform, persuade, incite and remind consumers directly or indirectly about the brands they sell (Keller, 2001). Marketing communication represent the voice of a brand and the means by which companies can establish a dialogue with consumers concerning their product offerings, detailed product information or even ignore the product all together to address other issues. Marketing communications can associate a brand with a specific person, place, experience or thing. In these and other ways, marketing communications allow marketers to transcend the physical nature of their products or their technical specifications of their services to imbue products and services with additional meaning and value. In doing so, marketing communications can contribute to greater brand experience and sustained consumer loyalty. In this context, advertising, sales promotion and event may influence what consumers think about products, what emotions they experience in purchasing and using them, and what behaviors they perform, including purchasing in particular stores and specific brands.

Trust

Trust evolves from past experience and prior interaction, individual's experiential process of learning over time Garbarino and Johnson, 1999). Trust as a confidence expectations of the brand's reliability and intentions (Delgado-Ballester and Munuera- Aleman, 2001). Interms of brand trust development, trust evolves from past experience and prior interaction and considers it through experience and trust develops over time. Researchers (Delgado et al, 2003, Garbarino and Johnson, 1999; Morgan and Hunt, 1999; Sirdeshmukh et al, 2002) trust is one of the factors that differentiate relationships whether personal or interpersonal with the brand from transactions. Interestingly, the research outcome on brand trust has been mixed and contradictory. At one extreme, those who see satisfaction is necessary but not sufficient for the formation of trust, and not all satisfied customers trust the brand (Hess and Story, 2005). Finally, trust will contribute to customer commitment as the maximum expression of a successful relationship between the consumer and the brand where to the extent to which customers feel they are 'in sync' with the brand so called resonance.

Conceptualization of Resonance

Resonance refers to the nature of the ultimate relationship and the extent to which customers feel they are 'in sync' with the brand (Keller, 2003). Brand resonance characterized by strong connections between consumer and the brand. Brands with strong resonance benefit from increase trust, commitment and customer active loyalty and decreased vulnerability to competitive marketing actions. In the CBBE model, the most valuable brand building block, brand resonance, occurs when all the others core brand values are completely "in sync" with respect to consumers' needs, wants and desires. In other words, brand resonance reflects a completely harmonious relationship between customers and the brand. With true brand resonance, customers have a high degree of loyalty marked by a close relationship with the brand such that customers actively seek means to interact with the brand and share their experiences with others. The challenge is to ensure the customer has the right experiences to create the right brand resonance (Keller, 2006). Consistent with (Hirschman and Holbrook, 1982, and Schmitt, 2009), this study proposes to conceptualize the effect of multi-sensory stimuli and emotive brand experience related to trust and resonance. Considering brand equity as a relational market-based asset implies that building and maintaining trust is at the core of brand equity because it is a key characteristic of any successful long-term relationship (Keller, 2003; Garbarino & Jonhson, 1999; Morgan & Hunt, 1994).

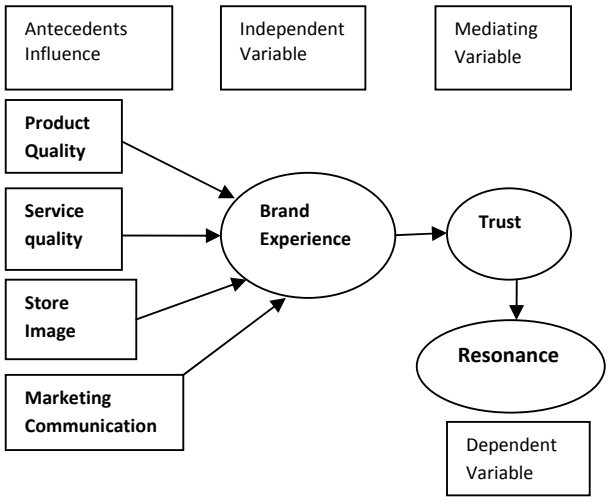


Figure 1: [The BRAND EXPE-RESONANCE Model] Source: Develop for this study

H1 : In the fast food consumption experience, product quality is positively associated with brand experience.
H2 : In the fast food consumption experience, service quality is positively associated with brand experience.
H3 : In the fast food consumption experience, store image is positively associated with brand experience.
H4 : In the fast food consumption experience, marketing communication is positively associated with brand experience.
H5 : In the fast food consumption experience, brand experience is positively associated with trust..
H6 : In the fast food consumption experience, trust is positively associated with resonance.

METHODOLOGY

Preliminary discussions with the operators and focus groups interview with selected experience respondents were carried out to identify issues and factors related to brand experience. This study will examined the antecedents influence of customers brand experiences and the consequences of trust on resonance of the four prominent fast food in Malaysia namely, Mc Donald's, Kentucky Fried Chicken, Pizza Hut and Kenny Rogers. Questionnaires will be distributed to 400 respondents using quota sampling. Descriptive analysis will be used to determine the perception of adult's customers and Structural Equation Modeling (SEM) will be utilized to determine the significant levels of associations and interactions between the variables tested.

RESULTS/CONCLUSION

The novelty of the present study is the contribution of original knowledge through the development of comprehensive brand experience dimensions and model. The conceptual model developed, for which could guide policy makers/ decision makers/ vendors/ producers/ operators, which is appropriate and useful in terms of decision making in the fast food industry in Malaysia especially on the issue of how to develop brand experience among customers. Moreover for practitioners, they could understand on how the factors of antecedents influence of brand experience and how the consequences of brand experience impact on resonance, directly and indirectly. Thus, by understanding the predictors of brand experience, the study may also help them to rethink and reposition themselves in light of the findings. Practitioners could carefully strategize the effective ways on how to improve customers' resonance towards the brand. Subsequently, the research is to endeavor the relationship involving brand models. This aid to better understanding of pre-requisite necessary to succeed in business especially in today competitive environment, and provides additional avenues of research in the area.

ACKNOWLEDGMENTS

The authors would like to thank lectures, colleague and friends for giving valuable advice, in-proof reading and in helping with technical glitches. Of course, we also wish to acknowledge Universiti Technologi MARA (UiTM) Malaysia, for its generous sponsorship, assistance and timely responses to queries and requests.

REFERENCES

[1] Aaker, D. A. (1991). *Managing brand equity, capitalizing on the value of a brand name*. New York: The Free Press.
[2] Brakus, J. J., Schmitt, B. H., & Zarantonello,L. (2009). Brand experience: What is it? How is it mesure? Does it affect loyalty? *Journal of Marketing, 73*, 52-68.
[3] Chee, L. K. (2008). The fast food market: A study of buying behaviour and restaurant image. Malaysian Institute of Management.
[4] Cronin, J. & Taylor, S. (1992). Measuring service quality: reexamination and extension. *Journal of Marketing, 56*(3), 55-68.
[5] Davis, S. M., & Dunn, M. (2002). *Building the brand-driven business, operationalize your brand to drive profitable growth* (1st ed.). San Francisco: Jossey-Bass-A Wiley Imprint.
[6] Delgado-Ballester, E. (2003). Development and validation of brand trust scale. *International Journal of Marketing Research*.
[7] Delgado-Ballester, E., & Munuera-Aleman, J. L. (2001). Brand trust in the context of consumer loyalty. *European Journal of Marketing, 35*(11/12), 1238-1258.
[8] Fournier, S. (1998). Consumers and their brands: developing relationship theory in consumer research. *Journal of Consumer Research, 24*(4), 343-373.
[9] Friedman, M. (1985). Consumer Boycotts in the United States,1970–1980: Contemporary Events in Historical Perspective. *The Journal of Consumer Affairs, 19*(1), 96-117.

[10] Garbarino, E., & Johnson, M. S. (1999).The different roles of satisfaction, trust and commitment in customer relationships. *Journal of Marketing, 63*(April), 70-87.

[11] Hess, J., & Story, J. (2005). Trust-based commitment: multidimensional consumer brand relationships. *Journal of Consumer Marketing, 22*(6), 313-322.

[12] Holbrook, M. B., & Hirschman, E. C. (1982). The experiential aspects of consumption: consumer fantasies, feelings and fun. *Journal of Consumer Research, 9*, 132-140.

[13] Keller, K.L & Lehman, D. R. (2001). The brand value chain: linking strategic and financial performance. Tuck School of Business, Dartmouth College.

[14] Keller, K.L. (2003). Strategic brand management: building, measuring and managing brand equity, (2nd ed.) Upper Saddle River, New Jersey: Prentice- Hall.

[15] Kotler, Philip & Amstrong, Gary. (2006). *Principles of marketing* (11th ed.). London.: Prentice- Hall

[16] Liss, D. (2002). Preparing for Crisis. From www.brandchanel.com

[17] Morgan, R. M., & Hunt, S. D. (1994). The commitment-trust theory of relationship marketing. *Journal of Marketing 58*, 20-38.

[18] Nestle. (2009). Nestlé boycott. From http://infao5501.ag5.mpisb. mpg.de:8080/topx/archive?link=Wikipedia-Lip6-2/875445.xml&style.

[19] Rozita, N. M., Azaruddin, A., & Asmah, Z. (2008a). *Fast food restaurants in Malaysia: are the key marketing strategies used serving a healthy food?*. Proceeding of the National Seminar on Science, Technology and Social Science 2008-Broadening Horizons through Research, Malaysia.

[20] Rozita, N. M., Azaruddin, A., & Asmah, Z. (2008b). *Fast food restaurants in Malaysia: is the food offered affecting the customers' health?*. Proceedings of the International Account & Business Conference 2008- Globalization Business & Financial Integration towards Economics Sustainablity, Malaysia.

[21] Schmitt, B. (2009). *The concept of brand experience. Journal of brand management, 16*(7), 417-419.

[22] Sherina, & Ahmad, R. (2004). Childhood Obesity: Contributing Factors, Consequences and Intervention. UPM Serdang & Ministry of Defence.

[23] Sirdeshmukh, D., Singh, J., & Sabol, B. (2002). Consumer trust, value and loyalty in relational exchanges. *Journal of Marketing, 66*(January), 15-37.

[24] Statistic, D. o. (2007). *Agri-Food Past, Present and Future Report Malaysia*: Agri- Food Trade Service Report. (A.-F. T. S. Report o. Document Number)

[25] Zeithaml, V. (2000). Service quality, profitability and the economic worth of customers: what we know and what we need to learn. *Journal of the Academy ofMarketing Science, 28*(1), pp. 67-85.

Effects of Advertising Three Abstraction Levels of Credibility on Consumers' Feelings, Attitudes and Intentions

Mazzini Muda[1,*], Associate Professor Dr. Rosidah Musa[2] and Dr. Lennora Putit[3]
[123]Faculty of Business Management, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia
*mazzinim@salam.uitm.edu.my

Abstract
Endorser and advertiser are two sources of credibility in advertising. Endorser credibility has been widely studied and documented, while advertiser credibility, or the reputation of the company, has received little attention. Moreover, ad credibility, or the truthfulness of claims made in the ad is also added as a construct. The objective of this paper is to develop, validate and test a comprehensive framework for the evaluation of celebrity-endorsed advertisements. Survey design via self-administered questionnaire will be used to collect data. Findings from the study are expected to extend the literature on source credibility in advertising and guide practitioners on development of creative advertisements.

Keywords
Celebrity credibility, advertiser credibility, ad credibility, feelings, advertising effectiveness

INTRODUCTION

Advertising environment is increasingly becoming cluttered. In order to make their ads stand out, many advertisers resort to hiring celebrities to endorse their brands in the advertisements. This is because celebrities are perceived to be credible source of communication. Not only celebrities can attract the attention of consumers, they also have been found to produce more positive attitude changes toward the position advocated and to induce more behavioral changes than other types of endorsers. The endorser or spokesperson as an important source in a company's marketing communications strategy has been widely studied.

On the other hand, another type of source credibility identified in marketing literature-the advertiser credibility- has received little coverage with regards to its impact on advertising effectiveness. Advertiser credibility or "corporate credibility" (Newell & Goldsmith, 2001, p. 235) refers to the extent to which consumers feel that the firm has the knowledge or ability to fulfill its claim and whether the firm can be trusted to tell the truth or not. LaBarbera (1982) predicts that companies with low credibility scores will have problems in creating demand, achieving brand preference and presenting effective ad messages. Very few empirical studies (except for Laferty & Goldsmith, 1999; Goldsmith, Lafferty & Newell, 2001) have examined the combined effects of endorser credibility and advertiser credibility on consumer attitudes toward the ad, attitudes toward the brand and purchase intentions – the three traditional measures of advertising effectiveness. In addition, another advertising effect that has not been empirically tested in the celebrity-endorsed ads is feelings evoked from the ads. Therefore, this study aims to determine the effects of the combined power of source credibility and ad credibility on consumer response to the advertisement, including feelings response. This is perhaps the first study that combines the three levels of credibility in a single advertisement.

LITERATURE REVIEW

Celebrity Credibility

Source credibility is a term often used to refer to the attributes of the communicator such as expertise, trustworthiness and attractiveness (Belch et al., 1987). A communicator with expertise is more persuasive because he or she posses knowledge, skill or experience. Furthermore, the source also has to be trustworthy, that is honest, ethical and believable. Ohanian (1990) adds attractiveness as another dimension of credibility as attractive people tend to be liked more, and are likely to have a positive influence on the product they advertised. Advertisers have many options for endorser: ordinary people, corporate leaders, experts and celebrities. However, only celebrities have the "stopping power" to draw people attention to the advertisements in a much cluttered media environment. Advertisers believe that a popular celebrity such as a singer, actor, athlete, musician and etc. will favorably influence consumers' attitudes and purchase behavior. Thus, it is hypothesized that:

H1: Consumers will have positive feelings evoked from the ad when the celebrity endorser is credible.
H2: Consumers will have positive attitude toward the ad when the celebrity endorser is credible.

Advertiser Credibility

Advertiser credibility is synonymous with "corporate credibility" (Newell & Goldsmith, 2001; Laferty & Goldsmith, 1999; Goldsmith, Lafferty & Newell, 2001) and "company credibility" (LaBarbera, 1982). It is the extent to which a company is perceived as having knowledge and ability to deliver quality products or services and telling the truth in its

communications with the consumers. In other words, advertiser credibility refers to the reputation of the company for honesty and expertise. Seems similar to endorser credibility, but Newell and Goldsmith (2001) argue that it is different because advertiser credibility does not possess the dimension of attractiveness. Therefore, this study also conceptualizes advertiser credibility as having only the dimensions of expertise and trustworthiness. Even though there is little empirical research on advertiser credibility, there were evidence to suggest that it is important in producing positive attitude changes toward the ad and the brand as well as influencing purchase intention (Fombrun, 1996). Furthermore, Goldberg and Hartwick (1990) conclude that company with positive reputation would be able to influence consumers to believe and trust their advertising messages. Asian consumers, for instance, would be concerned about the advertiser of the product and whether the company is a socially responsible company (Kotler et al., 2005). Therefore, based on previous literature, this study posits:

H3: Consumers will have positive feelings evoked from the ad when the advertiser is perceived as credible.
H4: Consumers will have positive attitude toward the ad when they perceived the advertiser as credible.

Advertisement or Ad Credibility

The credibility of the ad is defined as "the extent to which the consumers perceive claims made about the brand in the ad to be truthful and believable" (MacKenzie & Lutz, 1989, p. 51). It is based on the premise that consumers are motivated to evaluate the truthfulness of the ad claims (Kavanoor, Grewal & Blodgett, 1997). It is also synonymous with the concept of "ad believability" as conceptualized by Beltramini (1982). He defines ad believability as "the extent to which an ad is capable of evoking sufficient confidence in its truthfulness to render it acceptable to consumers (p. 56). It means that the contents of the ad, visual and verbal, will be subjected to close scrutiny by consumers. Ad credibility as the integrity of the ad, includes two dimensions of trustfulness and believability (Goldberg & Hartwick, 1990). Thus, credible ads tend to have greater extent of message acceptance, brand attitude and subsequently purchase intention (Despande & Stayman, 1994; Ohania, 1990). As such, we propose these hypotheses:

H5: Consumers will have positive attitude toward the ad when the ad is perceived as credible.
H6: Consumers will have positive attitude toward the brand when they perceived the ad as credible.

Feelings Evoked From the Ad

Feelings are defined as acute, transitory and specific affective experiences that occur as a result of some experience (Holbrook & O'Shaughnessy, 1984). Feeling responses to the ads have been identified as one of the important advertising effects (Mooradian, 1996). Feelings are generated by the ad itself and can occur very quickly (Zajonc, 1980), especially if activated by nonverbal elements of the ad (Edell, 1988). Subsequently, these feeling responses may then influence the nature of the subsequent processing of the ad. Burke and Edell (1987) suggest feelings as properties of individuals and the need to consider the source of feeling elicited from the ad. In the case of celebrity endorsement, the positive feelings can be generated from the celebrities that are well liked (Till, Haas & Priluck, 2006).

H7: Consumers who have positive feelings evoked from the ad will have positive attitude toward the ad.
H8: Consumers who have positive feelings evoked from the ad will have bigger purchase intention.

Advertising Effectiveness

Advertising is effective if it can achieve the objectives set prior to the implementation of the advertising campaign (Shimp, 2008). Usually, the most common way of measuring the effectiveness of advertising campaign is by measuring attitudes, purchase intentions and product beliefs (Solomon, 2007). Researchers commonly use multiattribute attitude models to explain attitudes, intentions and behavior. Fishbein Attitude Theory is a widely used model to measure advertising effectiveness (Fishbein, 1983; Solomon, 2007) as it breaks down the attitude into two separate constructs, attitude toward the ad (AAd) and attitude toward the brand (AB), and purchase intention (PI).

Mckenzie and Lutz (1989) define AAd as "a predisposition to respond in a favorable or unfavorable manner to a particular advertising stimulus during a particular exposure occasion" (p. 47). AAd may contain both, affective reaction (ad-created feelings of happiness) and evaluation (an ad's credibility or informativeness) (Baker and Lutz (1988). Emotionally, consumers form AAd by consciously processing the executional elements found in ad such as endorser, presentation style, colors and etcetera. Therefore, consumers may emotionally respond to the celebrity in the advertisement.

Attitude toward the brand (AB) attempts to influence brand choice by engendering favorable consumer attitudes toward the advertised brand (Shimp, 1981). This concept is achieved by structuring ads to influence consumers' beliefs and evaluations regarding the favorable consequences of consuming

the brand. AB includes beliefs formed from the ad, brand attribute information and inference based on ad picture contents (Gardner, 1985; Mitchell and Olson, 1981). Biehal et al. (1992) found that AB mediates the impact of the AAd on intentions in two ways, directly and indirectly. Directly, AAd and AB have separate influences on consumers' intention. Indirectly, AAd has an impact on AB; then AB affects the consumers' intentions. Thus, AB which includes beliefs formed from brand attribute information and inferences based on ad picture contents (Mitchell and Olson, 1981) mediates the impact of AAd on intention. Our next hypotheses are as follows:

H9: Consumers who have positive attitude toward the ad will have positive attitude toward the brand.

H10: Consumers who have positive attitude toward the ad will have bigger intention to purchase.

Intentions are "type of judgments about how in the present context, a consumer will behave towards a particular brand" (Biehal et al., 1992, p. 25). Intentions may be based on processing all the relevant and available brand information. A close relationship between intentions and choice may not always occur; consumers may make choices without completely processing all brand information (Biehal et al., 1992). Consumers may not even form overall evaluations/intentions either, but they may form attitudes toward the brand without making choices (Biehal et al., 1992). Woodside and Taylor (1978) hypothesize that the more the product is advertised, the higher the perceived quality it has and the more it will be consumed. The more advertised the brands are, the more easily recognizable they are, thus leading to greater consumption. Woodside and Taylor (1978) discover that consumers viewed products that are nationally advertised to be higher in quality and therefore its purchase intention increases. By creating greater confidence in the quality of the product, advertising may be more directly related to the purchase decision. Thus, we submit another hypothesis:

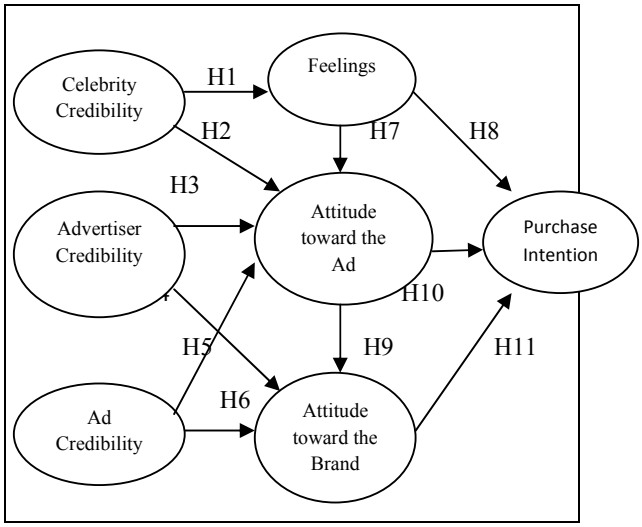
H11: Consumers who have positive attitude toward the brand will have bigger intention to purchase.

Figure 1 presents a proposed theoretical framework and hypothesized relationships among the constructs. A considerable amount of research has illustrated the sequential path of influence from AAd to AB, which subsequently can impact attitude toward purchase intention (Lafferty, Goldsmith & Newell, 2002; MacKenzie & Lutz, 1989; MacKenzie, Lutz & Belch, 1986; Mitchell & Olson, 1981).

METHODOLOGY

This study adopts a quantitative methodology via a cross-sectional survey. A self-administered questionnaire will be distributed to 600 respondents by drop-and-collect method. Due to the length of most doctoral questionnaires, the dropped off method is more suitable because respondents are given more time to concentrate on the questionnaire in private and respond to it whenever it is convenient to them. As stipulated population units are unavailable, alternatively quota sampling approach is chosen. The sampling frame targeted comprised of three major ethnic groups in Malaysia within the approximate ratio of 60:25:15 amongst Malays, Chinese and Indian respectively, based on Malaysia total population census in 2008. In addition, a relevant proportion of age group is also targeted amongst these target samples. Most measurement instruments are adapted from previous literature. However, scales will be tested for reliability, purified using Cronbach's alpha and later assessed for convergent and discriminate validity. To validate the measurement model, structural equation modeling (SEM) technique will be used.

Figure 1: Conceptual Model



CONCLUSION

This paper outlines a proposed doctoral research involving the use of celebrity endorser in advertising. Other than this source, another not-so-popularly research source in communication message - the company sponsoring the advertisement - is also investigated. Studies have shown that both, endorser and advertiser credibility are important determinants of consumers' attitudinal and behavioral changes. In addition, two new constructs, ad credibility and feelings evoked from the ad, are added to provide a comprehensive model to evaluate the effectiveness of celebrity-endorsed advertisements. As most models in advertising originate from the Western cultures, this study will

contribute to the application of those models into Eastern cultures. While in western cultures, people tend to hero-worship and idolize their celebrities, people here especially the Muslims are taught instead to take pious people amongst them as role models. For that reason, we may be surprised with different results.

REFERENCES

[1] Baker, M. J., & Lutz, R. (1988). The relevance-accessibility model of advertising effectiveness. In Hecker, S., Stewart, D. W. (Eds). *Nonverbal Communication in Advertising*, Lexington, MA: Lexington Books, 59-84.

[2] Belch, G.E., and Belch, M.A. (2004). *Advertising and promotion: An Integrated Marketing Communications Perspective* (6th Ed), McGraw-Hill, New York, NY.

[3] Belch, G.E., Belch, M.A., and Villarreal, A. (1987). Effects of advertising communications: review of research. *Research in Marketing*. Greenwich, CT: JAI press, 9, 59-117.

[4] Biehal, G., Stephens, D., and Curlo, D. (1992). Attitude toward the ad and brand choice. Journal of Advertising, 21(3), 19-36.

[5] Brown, W.J., and Basil, M.D. (1995). Media celebrities and public health: responses to 'Magic Johnson's HIV disclosure and its impact on AIDS risk and high-risk behavior. *Health Communication*, 7(4), 345-370.

[6] Edell, J. A. (1988). Nonverbal effects in ads: A review and synthesis. *Nonverbal Communication in Advertising,* 11-27.

[7] Edell, J. A., & Burke, M. C. (1987). The power of feelings in understanding advertising effects. *The Journal of Consumer Research*, 14(3), 421-433.

[8] Fishbein, M. (1983). An investigation of the relationship between beliefs about an object and the attitude toward the object. *Human Relations, 16*, 233-240.

[9] Fombrun, C. J. (1996). *Reputation: Realizing Value from Corporate Image*, Harvard Business School press, Boston, MA.

[10] Gardner, M. P. (1985). Does attitude toward the ad affect brand attitude under a brand evaluation set? *Journal of Marketing Research*, 22(2), 192 198.

[11] Goldberg, M.E., and Hartwick, J. (1990). The effects of advertiser reputation and extremity of advertising claim on advertising effectiveness. Journal of Consumer Research, 25(May), 172-179.

[12] Goldsmith, R. E., Lafferty, B.A., and Newell, S.J. (2000a). The impact of corporate credibility and celebrity credibility on consumer reaction to advertisements and brands. *Journal of Advertising*, 29(3), 43-54.

[13] Kotler, P., Keller, K.L., Ang, S.H., and Leong, S.M. (2009). Marketing Management: An Asian Perspective (5 th Ed.) Prentice Hall

[14] LaBarbera, P.A. (1982). Overcoming a no-reputation liability through documentation and advertising regulation. *Journal of Marketing Research*, 19, 223-8.

[15] Lafferty, B.A. and Goldsmith, R.E. (1999). Corporate credibility's role in consumers' attitudes and purchase intentions when a high versus low credibility endorser is used in the ad. Journal of Business research, 44(), 109-116.

[16] Newell, S. J. and Goldsmith, R. E. (2001). The development of a scale to measure perceived corporate credibility. *Journal of Business Research*, 52(3), 15-24.

[17] Ohanian, R. (1990). Construction and validation of a scale to measure celebrity endorsers' perceived expertise, trustworthiness, and attractiveness. *Journal of Advertising*, 19(3), 39-52.

[18] MacKenzie, S.B., and Lutz, R.J. (1989). An empirical examination of the structural antecedents of attitude toward the ad in an advertising pretesting context. *Journal of Marketing*, 53(April), 48-65.

[19] MacKenzie, S. B., Lutz, R. J. & Belch, G. E. (1986). The role of attitude toward the ad as a mediator of advertising effectiveness: A test of competing explanations. *Journal of Marketing Research, 23*, 130-143.

[20] Mitchell, a. A., & Olson, J. C. (1981). Are product attitude beliefs the only mediator of advertising effects on brand attitude? *Journal of Marketing Research,* 18(3), 318-332.

[21] Shimp, T. A. (1981). Attitude toward the ad as a mediator of consumer brand choice. *Journal of Advertising*, 10(2), 9-48.

[22] Shimp, T. A. (2008). Integrated marketing communications in advertising and promotion. Mason, OH: Thomson South-Western.

[23] Woodside, A.G., and Taylor, J.L. (1978).Consumer purchase intentions and perceptions of product quality and national advertising. Journal of Advertising, 7, 48-51.

Correlation between Technology Acceptance and Computer Anxiety among Employees In Commercial Banks: A Case Study

Maimunah Mohd Shah[1,*], Roshidi Hassan[1,2] and Ahmad Mazli Muhammad[1]
[1]Faculty of Business Management, [2] Universiti Teknologi MARA, Malaysia
*monamohdshah@yahoo.com

Abstract
The purpose of this paper is to share the issues in acceptance of technological changes and computer anxiety based on the demographic profile of the respondents who were employed in five commercial banks in Shah Alam. Commercial banks had been identified as actively using technology with high volumes of office activities with the biggest size of employees working there. Technology has changed drastically and has led to many challenges and affects all levels of management in organizations. Employees need to continually learn these new technologies with many applications implemented by the management. At the same time, employees might experience difficulties facing these changes and challenges, thus, these might be connected to computer anxiety. This anxiety is related to technology-related stress which is also known as technostress today. Using a set of questionnaire as a survey method, data were collected from 50 employees working in five commercial banks. Technology Acceptance Model developed by Davis (1989) was used to determine the level of technology acceptance among the employees. Whereas, Computer Anxiety Rating Scale developed by Heinssen (1987) was used to determine the level of computer anxiety. Another variable included in this study was computer knowledge. The findings revealed that the issues in accepting technological changes are positive and significantly related among the tested variables. The presence of technology did influence computer anxiety among employees in commercial banks. As a conclusion, although the changes of technology were positively accepted by employees, however, the presence of computer anxiety among them warrants further actions and considerations. Further study should be conducted to determine whether the attitude towards computer among employees does moderate the influence of technology acceptance with the level of computer anxiety among employees in all commercial banks especially in the headquarters.

Keywords
Technology acceptance, computer anxiety, computer knowledge

INTRODUCTION

Innovations and new inventions in technology have rapidly changed computer application technology in many business organizations. The creation of these technologies has given significant impact on commercial banks in the last two decades. They need to extend and take up the challenges with these up-to-date technologies to further strength their status to stabilize their business operations. The presence of quality and skilled workforce is very critical for many commercial banks. Therefore, management in commercial banks recruit their employees based on their academic qualifications and working experience besides acquiring other skills that fulfil the human resource policy. Employees need to be competent and ready to encounter these demands and challenges. They need to utilize their potential strengths to achieve the goals set by their top management. As stated by Gallivan (2004), changes in technology do affect IT professionals and IT Managers as well as everyone in the organization. Therefore, commercial bank employees need to be skilled when accomplishing their job tasks, duties and responsibilities especially when all these are concerning with technology applications. The widespread use of information and computer technology in commercial banks is to ensure their employees are proficient with technology. For instance, the presence of telecommunications, the Internet, computer application software and hardware and databases has impacted society and businesses at large. Employees encounter new challenges and need to adapt as quickly as possible besides continuously learn new technology applications implemented in the workplace (Hulbert, 1998). However, it is not simple to adapt with technology (Wolski & Johonson, 1999).

ISSUES IN TECHNOLOGY

Due to these rapid changes in technology, some employees are comfortable with the transitions. However, many others are still not comfortable using technology (May, 1998). When all employees are expected to be competent and computer literate, many of these computer users are struggling to accept the technology (Brod, 1984). Past studies (Benamati & Lederer, 2001, Gallivan, 2004, Venkatesh, Morris & Ackerman, 2001) reported that employees did experience difficulties when unable to cope up with the rapid changes in technology. The ability to cope with the changes would lead employees to accept technology and adopt it. However, employees who are not comfortable when using technology may experience technology-related stress also known as technostress.

Technostress is also identified as computer anxiety or computerphobia.

Technostresss

It is a machine-based stress that are felt by computer users when using technology such as online database, word processing and office systems. According to Brod (1984), technostress is "a modern disease of adaption caused by an inability to cope with the new computer technologies in a healthy manner." Employees would feel the pressure when performing office activities with their peers and superiors in the workplace. For example, feelings include feeling irritability, headaches, nightmares, resistance to learning about the computer or rejecting technology (Brod, 1984).

Computer anxiety

Oetting (1983) stated that "computer anxiety is a concept-specific anxiety because it is a feeling that is associated with a specific situation, in this case when a person interacts with computers." Similarly, Cambre and Cook (1985) termed that computer anxiety as "a form of state anxiety, and it was brought on in part by the rapidly changing nature of new technology and the subsequent pressure for social change in modern time." Heinssen, Glass and Knight (1987) coined that "computer anxiety refers to negative emotions and cognitions evoked in actual or imaginary interactions with computer-based technology, at it affects the utilization of computer-based technology and performance tasks that involve the use of computers."

Technology Acceptance Model (TAM)

This model was developed by Davis (1989) and highlighted the issue of how computer users come to accept and use technology. Perceived ease of use of technology and perceived usefulness of technology are the two specific variables hypothesized to be important determinants of user acceptance. Perceived ease of use (PeU) is the "degree to which individual believes that using a particular technology would be free of effort. Perceived usefulness (PU) is "the degree to which an individual believes that using a particular technology would increase his/her job performance." TAM has been used by earlier researchers to measure the level of technology acceptance. Thus, this model was also adopted by the current researchers to measure the acceptance level when using technology among employees in commercial banks.

Computer knowledge

It is the ability of employees when using common computer applications throughout their working years such as word processing, spreadsheets, database programs, e-mail and etc.

PREVIOUS STUDIES ON TECHNOSTRESS

One of the studies on technostress conducted in Malaysia involved 80 academic and non-academic staff from Pulau Pinang and Terengganu. Personnel Technostress Inventory questionnaire was used to measure the level of technostress. Domains included in the study were learning, border, communication, time, family, workplace and community. A moderate level of stress among the respondents was revealed, however, there was no significant difference of stress in term of gender and occupation. (Ibrahim, Bakar and Nor, 2006). In another study, Embi (2007) investigated the levels of computer anxiety, computer self-efficacy and computer applications usage among accounting lecturers in UiTM. He collected 262 responses using a survey method. The results revealed that majority of the respondents had low levels of computer anxiety and high levels of self-efficacy. In the following study, a relationship between the elements of working and stress in six commercial banks was conducted by Wai, Ching and Rahim (2003). They used 111 cases for data analysis. They found that some of the pointers that lead to stress included the size of working area, lighting intensity and noise level. They reported that the employees preferred large working environment with bright lighting and low noise. Technostress in China was reported by Tu & Wang (2005). Information technologies have greatly influenced businesses and people's daily life in China. Therefore, many Chinese were starting to experience technostress although the technology was supposed to be providing convenience to computer users. However, the research was their early initiative to further focus on what hadcaused technostress and finding strategies to cope with it. Findings from various studies on computer phobia which is another term for technostress or computer anxiety conducted by researchers in USA were reported by Levez (2004). The most common PC problems were slow-speed PC, PC crashes, Windows freezes, slow boot up, slow shut down, slow loading programs, unable to run many programs and PC restarts by itself. Surprisingly, a study conducted by security software vendor Symantec found that when confronted with technical problems, more than 40% of users surveyed swore at, kicked or otherwise abused their computers. 75% of callers refused to read the manual for the computers. A study on software documentation found that 47% of respondents ranked manuals as the least effective method for learning to operate computers and software. Oral instruction was found to be the most effective method for learning to operate software (Levez, 2004).

RESEARCH QUESTIONS (RQ)

1. What are the level of technology acceptance based on perceived ease of use and perceived usefulness of technology among employees working in five commercial banks?

2. Based on the demographic profile, what are the levels of computer anxiety indicated from the total composite score of the respondents?
3. Is there a correlation between perceived ease of use and perceived usefulness with computer anxiety among employees in commercial banks?

METHODOLOGY

In this case study, 70 questionnaires were distributed randomly to five commercial bank employees in Shah Alam via representatives identified by the researcher. For collecting data, the questionnaire comprised of Section A which included questions on the demographic background of the respondents such as name of bank, gender, age, highest qualification, category (non-executive or executive), length of service and salary. Section B focused on the issues involved in the acceptance of technological changes among the respondents. As mentioned earlier, two variables from TAM scale were used to measure the acceptance of technology used by respondents. A seven-point Likert scale was used with values ranging from strongly disagree to strongly disagree. Section C measured the computer experience which included computer knowledge or competency of the respondents. The details comprised of technical skills, operating systems tasks and using e-mail. Items listed were seeking whether the respondents are having "no knowledge" to "I am expert". Measuring computer anxiety was described in the last section.

Validity and reliability

The result of Cronbach's alpha for perceived ease of use was 0.916, perceived usefulness was 0.952, Computer knowledge was 0.870 and computer anxiety was 0.87. The results indicate a reliable mean for the purpose of the study as it was above 0.70 (Pallant, 2007). Therefore, the data suggested that the questionnaire was a reliable instrument that consistently measuring the level of each variable of the study.

DATA ANALYSIS AND FINDINGS

Out of 70, only 50 questionnaires were analyzed in this study. A cross-tabulation was performed between demographic profile of the respondents with computer anxiety. The bivariate correlation analysis used the pearson product moment correlation coefficient (pearson "r") to measure the association between the independent and dependent variables. The total composite computer anxiety scores were analyzed and grouped into three different levels. The possible total composite computer anxiety scores ranged from 13-91 using 13 items with a seven-point rating scale (1=strongly disagree to 7=strongly agree). The degree of anxiety was sorted into three categories: scores ranging between 13-38 were categorized as low anxiety, 39-64 as moderate anxiety and 65-91 as high anxiety. Respondents with high scores indicate that they are having high level of computer anxiety.

Discussion

RQ1: Perceived ease of use of technology

The result indicated a rather high agreement among respondents on the perceived ease of use of technology with the mean score of 5.10 and the standard deviation of 0.916. The most frequently occurring perception about the perceived ease of use of technology among respondents was interaction with the bank was clear and understandable, followed by the perception that the bank system was easy to use. The next perception was learning to operate the bank system was easy, followed by it was easy to become skilful at using the bank system and it is easy to get the bank system to do what I wanted to do. The lowest level of perception about the perceived ease of use of technology was the bank system is flexible to interact with.

Perceived ease of use of technology has been shown to be an important factor in the studies of information technology acceptance (Davis, 1989; Ndubisi, 2003; Ndubisi, 2005; Dias, 1998; Venkatesh & Brown, 2001).

RQ1: Perceived usefulness

For perceived usefulness, the result indicated a rather high agreement among respondents on the perceived usefulness of technology with the mean score of 5.563 and the standard deviation of 0.885. The most frequently occurring perception about the perceived usefulness of technology among respondents was using the bank system in the job would increase productivity, followed by the perception that the bank system would make it easier to do their job. The next perception was the bank system was useful in the job, followed by the bank system in the job would enable them to accomplish tasks more quickly and the bank system would improve their job performance. The lowest level of perception about the perceived usefulness was the bank system would enhance their effectiveness on the job.

Hence, perceived usefulness of technology can be a powerful medium for improving acceptance and utilization of innovative information technologies.

Research Question 2

In order to measure the levels of computer anxiety among the employees, Computer Anxiety Rating Scale by Heinssen (1987) was used. The highest level of computer anxiety of the respondents was using e-mail (m=5.19, sd=.843). The level of employees' computer anxiety in descending order from the highest to the lowest mean is shown in the table. High mean score indicates a higher level of computer anxiety while lower mean score indicates lower level of computer anxiety.

Table 2: Level of computer anxiety

N=50	Level of computer anxiety: Low computer anxiety %	Moderate computer anxiety %	High computer anxiety %	Total %
Banks		42	58	100
Gender				
Male		12	20	32
Female		30	38	68
Category				
Non-executive		24	24	48
Executive		18	34	52
Qualification				
Spm/stpm/diploma		32	42	74
Bachelor/Master		10	16	26
Salary				
Rm1000-rm2500		16	18	34
Rm2501-above		26	40	66
Age				
20-30		12	14	26
31-40		26	32	58
41-above		4	12	16
No. of years working				
1-10		16	18	34
11-20		24	32	56
21-above		2	8	10

The table above reveals differences in levels of computer anxiety following the demographic profile of the respondents. Generally, all respondents experienced from moderate to high computer anxiety. No respondents experienced low computer anxiety. Moderate and high computer anxiety were experienced by employees in five banks with 42% and 58% respectively. The details of the percentage for each bank are revealed in other tables in the study. In terms of gender, 68% of female working for these five banks experienced computer anxiety whereas male shows 32% which means computer anxiety experienced by male was less than female. There were many factors contributing to this result, for instance, many males spent most of the time using computers for various lookouts or work while females had more extra responsibilities, for example, they were not only thinking about jobs, perhaps other important tasks they needed to focus include thinking of the welfare of the family, social activities and personal needs. Pointing at the category of the employees, 48% of non-executives experienced computer anxiety as compared to 52% by the executives. Here, although the percentage is close, these results are said to be logical because executives are normally bearing more responsibilities, for example, they are making decisions and solving problems in the workplace – yes, including male executives! Looking at the qualifications of the respondents, the results revealed that 74% of the respondents with either SPM or STPM or Diploma experience computer anxiety more than respondents who have Bachelor's or Master's Degree with only 26%. Perhaps, non-executive categories of respondents are dealing more with office operations and activities as compared to those in the executive category. However, interesting results also revealed that respondents with a salary range from RM2501 and above experienced computer anxiety more than those respondents who earned less. In terms of age, it was grouped into three ranges. The results showed that respondents from age 31-40 experienced computer anxiety higher with 58% than the other ranges, 20 – 30 years old (26%) and 41 and above years old of respondents with 16%. Finally, from the number of years working, it is observed that 56% of the respondents working from 11 – 20 years in the banks experienced computer anxiety more than those (34%) who were within 10 years and those (16%) who had work for more than 20 years in the banks.

Research Question 3.

In order to test the correlation between the variables, perceived ease of use and perceived usefulness were computed for the overall mean. The same computation was done on computer anxiety. Table from Cohen (1988), as cited in Pallant (2007) was used to interpret the output of the correlation between the variables. This particular table provides the explanation on the strength of the relationship in terms of the value of Pearson Correlation (r) and the direction of the relationship for the variables used in this study. The relationship between perceived ease of use and perceived usefulness was tested. Then, both indicators which determine acceptances of technology were tested with computer anxiety. There is a medium correlation between perceived ease of use and perceived usefulness between the two dimensions with N= 50, r = .469, p <.01). When testing a correlation between perceived ease of use with computer anxiety, the results revealed there was a medium correlation with r = .302 between the two. However, there was no correlation between perceived usefulness with computer anxiety.

CONCLUSION

The respondents strongly perceived that the use of technology in their workplace as easy and learning and to use the system was also clear and understandable. Due to their exposure handling the technology, the employees were very supportive in adopting technological changes in the workplace. Perceived usefulness and perceived ease of use of technology can be a powerful medium for improving acceptance and utilization of innovative information technologies among the users.

However, despite accepting technological changes in the workplace, the respondents from these five commercial banks were experiencing computer anxiety. The implications would be the productivity would be at risks should the causes associated with the level of computer anxiety are not properly addressed.

RECOMMENDATIONS

Further research should be conducted to further reveal these interesting mixed results. Perhaps, attitude towards computer users among the employees in commercial banks may need to be considered as a moderating variable should a future study is to be conducted.

REFERENCES

[1] Benamati, J. & Lederer, A. L. The effect of rapid IT change on the demand for training. Proceedings of ACM Special Interest Group on Computer Personnel Research, San Diego, CA. (2001).

[2] Brod, C. Technostress: The Human Cost of the Computer Revolution, Addison, Wesley, Reading, MA. (1984).

[3] Cambre, M. A., & Cook, D. L. Computer anxiety; definition, measurement and correlates. Journal of Educational Computing Research, 1(1), 37-54. (1985).

[4] Davis, F. D. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319-340. (1989).

[5] Dias, D. S. Manager's motivation for using information technology. Industrial Management & Data Systems, 98(7), 338-342. (1998).

[6] Embi, R.. Computer Anxiety and Computer Self-Efficacy Among Accounting Educators At UiTM, Malaysia. *PhD Dissertation, Faculty of Technical Education*. (2007).

[7] Ibrahim, R. Z. A. R., Bakar, A. A., & Nor, S. B. M. Technostress: A Study Among Academic and Non Academic Staff, *Unpublished article*. (2006).

[8] Levez, B. Computer phobia and computer aversion. *PC World, UK. Retrieved on 24 June 2010*. (2004).

[9] Gallivan, M. J. Examining IT professionals' adaptation to technological change: The influence of gender and personal attributes. The Data Base for Advances in Information Systems, 35 (3). (2004).

[10] Heinssen, R. K., Glass, C. R. & Knight, L. A. Assessing computer anxiety: Development and validation of the computer anxiety rating scale. Computers in Human Behavior, 3, 49-59. (1987).

[11] Hulbert, D. J. Libraries and librarianship in the information age. (1998).

[12] Ndubisi, N.O. Effect of perception and personal traits on computer technology adoption by women entrepreneurs in Malaysia. Journal of Asia Entrepreneurship and Sustainability, 1(1), 1-23. (2005).

[13] Ndubisi, N. O., Gupta, O. K. & Massoud, S. Organizational learning and vendor support quality by the usage of application software packages: A study of Asian entrepreneurs. Journal of Systems Science and Systems Engineering, 12(3), 314-331. (2003).

[14] Oetting, E. R. Manual: Oetting's computer anxiety scale (COMPAS). Ft. Collins, Colorado: Tri-Ethnic Center for Prevention Research, Colorado State University. (1983).

[15] Pallant, J. SPSS Survival manual, A step by step guide to data analysis using SPSS, 3rd edition. A&U Australia. (2007).

[16] Tu, J. Q., & Wang, K. A large-scale empirical investigation of computer-related technostress: preliminary results from China. *Communications of the ACM, 48*(4), 2170-2176. (2005).

[17] Venkatesh, V. & Brown, S. A. A longitudinal investigation of personal computers in homes: Adoption determinants and emerging challenges. MIS Quarterly, 25(1), 71-102. (2001).

[18] Venkatesh, V., Morris, M. G. & Ackerman, P. L. A longitudinal field investigation of gender differences in individual technology adoption decision making processes. Organizational Behaviour and Human Decision Processes, 83, 33-60. (2000).

[19 Wai, C. K., Ching, P. W., & Rahim, M. F. A. Working environment and stress: a survey on Malaysian employees in commercial banks. *Malaysian Management Review*. (2003).

[20] Wolski, S., & Jackson, S. Technological diffusion within educational institutions: Applying the technology acceptance model. (1999).

Supplier Selection And Their Optimum Order Allocation: A Conceptual Framework

Mahbubul Haque'
International Islamic University Malaysia

Addressing Parking and Cordon Pricing Problems in Central Business District

Kian Ahmadi Azari[1,*], Sulistyo Arintono[2]
[1,2]Department of Civil Engineering, Faculty of Engineering, University Putra Malaysia, 43400 Serdang, Selangor, Malaysia.
*Kian_2001us@yahoo.com

Abstract
The aim of this research is to gain a greater insight into the behavior of travelers to parking and cordon pricing regimes within Central Business District.

Keywords
Cordon pricing, driver`s behavior, parking pricing.

INTRODUCTION

In the last years it has been widely recognized by analysts that parking management [1] and cordon pricing policies [2] have great potential to divert travel demand from private modes (cars, motorbikes,...) towards Public Transportation System (bus, metro,...) and thus, to contribute to reduced congestion (and other traffic-related undesired impacts) in urban areas, especially in their Central Business District (CBD), Therefore this aim can be accomplished by investigating driver`s behavior and their responses to pricing regimes[3].

Generally, most planners use parking policies like parking pricing due to its low cost and simple operating [4]. After that, if these policy can not responsible for traffic management, testing the congestion pricing (road pricing) to further strengthen the effectiveness of traveling behavior management seems necessary.

Implementation of cordon pricing certainly, would change the habit and preference of travelers in selecting the modes and parking locations. The aim at evaluating the difference in attributes towards traveler`s behavior with the presence of cordon pricing have often been ignored as the efficient means of parkers' satisfactions and may cause some drawbacks. Three key problems are discussed here, they include:

- Satisfactions to parking condition
- Cordon pricing and parking charges
- Tourist behavior

DATA COLLECTION

On March 2009, a random sample size of 1600 respondents was selected to perform a comprehensive survey to identify the role of the cordon and parking pricing implementation on travelers in central business district of Mashhad city, Iran.

RESULT

The lack of traveler satisfactions to Parking conditions in and outside the cordon area is one of the problems stated in this research. Parking condition may refer to the situation or capacity of the parking supplies. As an example this survey has shown that on average of the trip purpose (worker, non-worker and tourist) only about 23.8% of respondents stated the good parking condition and the rest 64.2%, have not been satisfied with the current situation available in the restricted traffic zone (see Figure 1). Moreover, the percentage of acceptance and non acceptance of parking condition outside the traffic zone were 26.1% and 47.3% respectively.

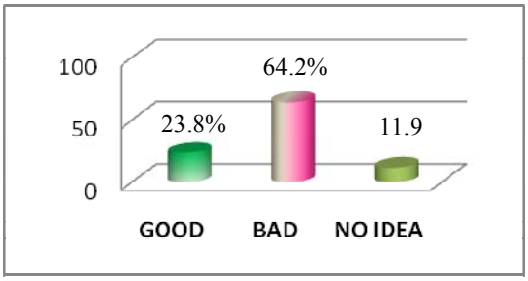


Figure 1. Satisfactions to Parking Situations inside the Cordon area

One of the important obstacle declared by travelers were inappropriate cordon pricing and parking charges in and outside the cordon area. Lack of proper pricing due to contrast cordon and parking charges will probably cause weak affection on demand and traffic congestion at the fringe of CBD and production of air pollution. As a result the aim to improve the best mode choice which considers best parking choices will fade away. For instance, the survey has been done in Mashhad city presents that about 60% of travelers do not agree with the present cordon charges implemented in a restricted traffic zone but 30% accepted the current pricing (see Figure 2). In the case of parking charges, on average 21.5% of drivers responded that the parking fees are high versa the majority of them, 63.5% have no idea and 15% believe the tariffs is low.

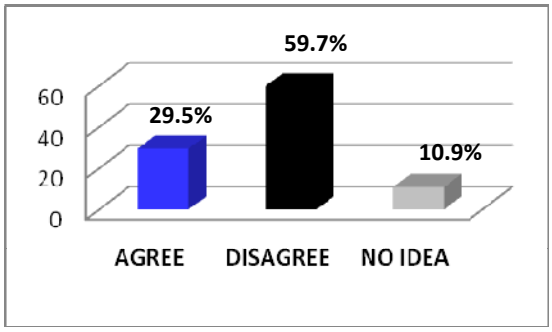


Figure 2. Travelers Responsiveness to Cordon Charges

The next problem which should be discussed is the different tourist behavior in travel pattern (e.g., shifting travel time), residential location and the willingness to pay. Tourists as one of the major traveler categories behave differently due to the particular trip purpose. As they can change their residential location and shifting the time of their travel, their behavior on travel pattern vary and cannot be same from workers and non workers trip purposes. To prove this argument, considering the case in which tourists respond to Mashhad restricted traffic zone, their behavior on changing the residential location, whether they have shifted or not after execution of the cordon pricing, can be clearly shown. The research demonstrates the effect of applying cordon pricing on tourist residential choice locations by about 60%.

The other important difference is tourist willingness to pay (figure 4). Based on this research tourists refuse to bring their private vehicle inside the cordon area and prefer not to pay the toll and park it outside the central business district. In contrast 85.5% of locals tend to use their cars and park inside the CBD.

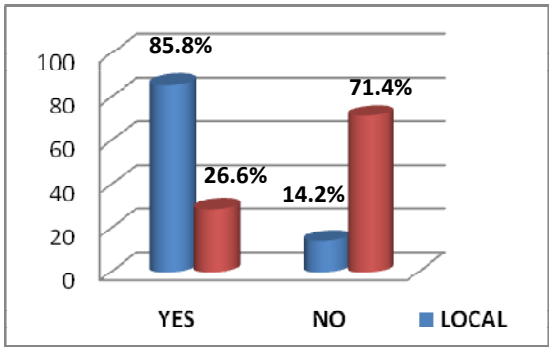


Figure 4. Willingness to Pay Due to Cordon Pricing

CONCLUSION

The current tendency in research is to attempt to address driver's behavior towards policy measures, such as the parking and cordon fares. Furthermore, they can be used as tools to assess the effectiveness of both parking and cordon related policies, as well as their impacts on drivers. In particular, this research will help us not to introduce parking and cordon pricing implementation problems but guide to find out travelers mode and parking choice in order to overcome weak policies in the following cases:

1. Decreasing traffic congestion inside and outside (at the fringe) of the CBD with a well organized parking & cordon pricing schemes,
2. Introduction of car usage charges with the implementation of parking charges instead of road charges,
3. Optimum occupancy for parking lots and road surfaces by executing better charges,
4. Off-street versus on-street (kerb) parking pricing policies,
5. Introduction of new policy for tourist`s attraction inside the CBD.

In order to overcome the problem stated like parking conditions and charges and even improving mode choice considering the execution of cordon pricing it is necessary to understand the behavior of drivers and their responsiveness to travel and parking attributes. Therefore, now the question is how we can promote parking choice with considering cordon pricing or how congestion pricing (cordon pricing) affects traveler parking choice behavior.

REFERENCES

[1] Hess, S. P., J.W. "Mixed Logit estimation of parking type choice" . *The 83rd Annual Meeting of the Transportation Research Board*, Washington D.C (2004).

[2] Feng, S. W. and J. J. Ye. "A Comparative Study of Parking and Congestion Charge Policies based on Transport Mode Choice Estimation. Intelligent Transportation Systems" ITSC 2008. 11th International IEEE (2008).

[3] Hensher, D. A. and J. King. "Parking demand and responsiveness to supply, pricing and location in the Sydney central business district" *Transportation Research Part A*: Policy and Practice 35(3): (2001) 177-196.

[4] Feeney, B. P. "A review of the impact of parking policy measures on travel demand" *Transportation Planning and Technology*, 13(4), (1989) 229 - 244.

ORAL

SOCIAL SCIENCES

Emotional Intelligent and the Relationship between Job Satisfaction and Organizational Commitment of Secondary Teacher in Bandaraya Kota Kinabalu, Sabah

Noorhafeza Herliani Adey[1], Beddu Salam Baco[2], Ferlis Bullare @ Bahari[3]
Universiti Malaysia Sabah

ABSTRACT

This research will examine the mediating effect of emotional intelligent on the relationship between job satisfaction and organizational commitment. Three hundred and thirty eight teachers randomly drawn from thirty seven public secondary schools in Bandaraya Kota Kinabalu, Sabah constituted the study sample. Variables in the study were assessed using four validated instruments. The questionnaires consists of items that measure level of emotional intelligent by Mayer and Salovey in 1997 and modified and translated by Beddu, Chua, and Harris (2003), items that measure level of job satisfaction constructed by Spector in 1976 and items that measure level of job commitment Mayer, Salovey and Caruso in 1999. Descriptive statistics, Pearson Product Moment Correlation and hierarchical regression analysis were employed to analyze the data. Then the data were analyzed based on descriptive and inferential statistic by using the "Statistical Package for Social Sciences" (SPSS version 18.0 for windows). Researcher predicted that will be a significant findings impact of job satisfaction on organizational commitment and that emotional intelligent mediates the relationship between job satisfaction and organizational commitment. Based on these predictions, it is suggested that emotional intelligent could be used as an intervention to enhance organizational commitment.

Key Words

Emotional intelligent, job satisfaction, organizational commitment, secondary teachers

INTRODUCTION

In the recent times, there have been overwhelming complaints among teachers about their overloaded job commitment juggling between teaching and after school commitment (Noriah *et al.,* 2000). The complaints generally centred on promotional opportunities, pay satisfaction, considerate and participative supervision, opportunities to interact with peers, a variety of duties and high degree of control over work methods and space (Villard, 2004).

The reason why organizational commitment has been interest to worker in the field is because of its empirical linkage with certain work-related behaviours such as turn over, absenteeism and job performance (Ferlis, 2000).

PURPOSE OF STUDY

Much as the literature on the relationship between job satisfaction and organizational commitment are bounteous, there still dearth of evidence on moderating influence of other factors. By investigating the moderating influence of emotional intelligent on the relationship between job satisfaction and organizational commitment, the present study offers a new direction on the role played by emotional intelligent in work attitude outcome.

RESEARCH QUESTION

Based on the articulated objectives of the study, the following research questions were addressed in the study.

- Would there be a significant and positive impact of job satisfaction on organizational commitment?
- Would emotional intelligent moderates the relationship between job satisfaction and organizational commitment?

MATERIALS AND METHODS

Design

The study employed descriptive survey research design using ex-post facto type. In this kind of study, no manipulation involved. It is an after fact study.

Participants

The samples of study were 338 participants randomly drawn from 37 public secondary schools in Bandaraya Kota Kinabalu, Sabah.

Instrumentation

Three instruments were used in the study to assess emotional intelligent, job satisfaction, and organizational commitment. Respondents were also requested to supply information about their marital status, qualifications, gender, working experience, age and teaching field. A brief description of each of the scale is given bellow.

EMOTIONAL INTELLIGENT

Emotional intelligent was assessed by using Emotional Competency Inventory (ECI) questionnaire developed by Mayer *et al.* (1997). The instrument has total of 63 items with responses

ranging from consistently (5) to never (1). An example of scale item: Happy with my private life. A Cronbach Alpha of 0.85 was found for the internal consistency of the scale. It also has a test-retest reliability of 0.75. The scale also shows evidence of validity as scores on the scale shown to be related to eight of the nine measures predicted the emotional intelligent. As indicated by Lazzari, the scale has a Cronbach Alpha of 0.81.

JOB SATISFACTION

Job satisfaction was assessed by using the Job Satisfaction Scale (JSS) developed by Spector (1976). The instrument has total of 36 items with response format ranging from agree very much (6) to disagree very much (1). An example of the item is: "I like doing things I do at work". A Cronbach Alpha of 0.91 was found for the internal consistency of the scale.

ORGANIZATIONAL COMMITMENT

This was measured with Organizational Commitment Questionnaire (OCQ) developed by Mayer *et al.* (1999). The scale has 24 items with a response format anchor on seven point scale strongly agree (7) and strongly disagree (1) An example of the scale item is: "I have too much to do at work". Coefficient Alpha value range between 0.70 to 0.91.

PROCEDURE

The research instruments were administered on 338 secondary school teachers using drop-off and pick-up method whereby the respondents were given a week to respond to the questionnaires. The researcher was assisted in the instruments by school counsellor in the selected organizations.

METHOD OF DATA ANALYSIS

The influence of demographic factors on organizational commitment is documented in literature (Mayer *et al*., 1999). To really ascertain the moderating influence of emotional intelligent on the relationship between job satisfaction and organizational commitment, it considered proper that demographic factors such as age, sex, marital status, qualification, working experience and organizational tenure, are controlled in the statistical analysis to reduce the possibility of spurious relationship based on unmeasured variables. Since the aforementioned are categorical in nature, they were coded as dummy variable.

Hierarchical aggression analysis (Cohen and Cohen, 1975) was employed as tools of analysis. A three-step procedure was used. Personal factors were entered first, followed by the main effects of the job satisfaction and emotional intelligent in the second step. In the third stage, the interaction term (job satisfaction x emotional intelligent) were entered into the regression equation. The F-change was assessed and the significance and contribution of each variable were determined using the standardized beta and t-ratio was interpreted. The moderating influence of emotional intelligent was tested through the examination of the interaction term. Assuming that the interaction term was significant, emotional intelligent would then deem to moderate the relationship between job satisfaction and organizational commitment.

CONCLUSION

From the literature evidence so far reported, the impact of emotional intelligent on real life is now beyond conjecture. Emotional intelligent skills and competences are usable and valuable tools in understanding, supporting, maintaining and enhancing high level of job satisfaction and organizational commitment.

The development of committed employee has several advantages to it. Realization of organizational goals depends to some extent on having committed workforce.

In conclusion, it is important to note that without good understanding of the relationship between job satisfaction and organizational commitment and the moderating influence of emotional intelligent in the relationship, whatever intervention is done to enhance organizational commitment may not achieve the expected result (Ademo, 2007).

ACKNOWLEDGEMENTS

The authors thank the financial supports providing from UMS Research Grant Scheme (Project GPS0033-SSK—1/2009).

REFERENCES

[1] Cohen, J. and P. Cohen. (1975). Applied multiple regression/correlation analysis for the behavioural science. New Jersey: Lawrence Erlbaum Association.

[2] D.A. Adeyemo (2007). Emotional Intelligence and the relationship between job satisfaction and organizational commitment of employee in public parastatals in Oyo State, Nigeria. *Medwell Journal of Social Science,* 4 (2): 324-330.

[3] Ferlis Bahari. (2000). *Hubungan Kepuasan Kerja dengan Komitmen Organisasi: Satu Kajian di Telekom Malaysia Berhad (Zon Sabah)*. Sekolah Psikologi dan Kerja Sosial. Malaysia: Universiti Malaysia Sabah.

[4] Harris Shah Abd. Hamid, Beddu Salam Baco, Chua Bee Seok. (2003). *Emotional competence inventory* (terj.). Malaysia: Universiti Malaysia Sabah.

[5] Mayer J. D. & Salovey, P. & Caruso, D. (1999). *Competing model of intelligence.* Handbook of Human Intelligence. New York: Cambridge.

[6] Mayer J. D. & Salovey, P. (1997). *What is emotional intelligence?*. New York: Basic Books.

[7] Noriah Mohd Ishak, Siti Rahayah Ariffin, Saemah Rahman, & Zuria Mahmud (2000). Correlation between emotional intelligence and performance among Malaysian adolenscence. *Paper presented at Learning Conference*. Spetse: Greece.

[8] Spector, P.E. (1976). Choosing response categories for summated rating scales. *Journal of Applied Psychology, 61,* 374-375.

[9] Villard, J.A. (2004). *Determining the relationship between job satisfaction of country extension intelligence of extersion country chairs*. Unpublished Ph.D. USA: The Ohio State University.

Implementation of Environmental Education in Malaysia and Nigeria

Akinnuoye Modupe Agnes and Abd Rahim Md Nor
School of Social, Development and Environmental Studies,
Faculty of Social Science and Humanities, Universiti Kebangsaan Malaysia,
UKM, Bangi, 43600 Kajang, Selangor Darul Ehsan, Malaysia
E-mail:akinnnuoye@yahoo.com; Phone: +60166104495.

Abstract
Environmental Education (E.E.) is an open way to environmental consciousness that promotes development and sustainability. The positive and negative transitions of development around the world are scenarios that call for stimulation and re-orientation of global implementation of environmental education in schools in order to reduce environmental abuse and degradation in our contemporary world. This paper is a review of some selected secondary schools settings in Malaysia and Nigeria to identify the methods of implementation, the problems and challenges that are militating against environmental education policies and implementation in both countries. The results reveal that Malaysian schools have a better implementation approach. There are more facilities in secondary schools with conducive environment. More than 75 % of students in Malaysian schools have better environmental education awareness as against their counterparts in Nigerian with regular community development programmes embedded in the schools curricula.

Keywords
Environmental Education, sustainability, implementation, policy, Malaysian and Nigerian schools.

INTRODUCTION

The United Nation Conference on Human and Environment held in Stockholm in 1972 in which it endorsed Environmental Education in its recommendation 96 and in 1976 after the Tbilisi conference, the result of which led to Environmental Education (E.E.) being included in school curriculum were significant steps in redefining and re-establishment of environmental education[1]. Subsequent follow-ups which include the Rio de Janeiro Earth Summit in 1992 encouraged sustainable development and environmental protection. The objective in part, was to considerably reduce or phase out environmental problems in developing countries through the teaching of environmental education in schools [2]. Furthermore, the Agenda 21 of 1996 proclaimed the integration of environmental education. However, much is left to be desired in achieving world sustainable development with the full application or practical implementation [3].

In 1998, Danish University Consortium for Environment, Development (D.U.C.E.D.) with Industry and Urban Areas established a measure in its efforts to fight environmental problems through environmental education leading to Danish environmental aid being given to Malaysia, Thailand and South Africa in order to set up the teaching of inter-disciplinary courses on environment in the respective benefiting nations. In turn, M.U.C.E.D., T.U.C.E.D. and S.A.D.U.C.E.D. were established respectively in Malaysia, Thailand and South Africa and the inclusion of environmental education in national policy agenda [4]. Although the importance of environmental education and Green strategies of the National environmental policy was mentioned for the vision 2020 in Malaysia, there has not been adequate coordination and structuring towards effective implementation in schools. So this has become a great challenge.

However, Nigeria among many other developing countries is beginning to realize the role of environmental education in solving environmental issues. The Nigerian Ministry of Education embarked on National Environmental Education program in schools towards sustainable development as far back as 1990 with the effort of the Nigeria Conservation Foundation (N.C.F.) [5]. The national workshop on integration of environmental education gave an *impetus* research studies with emphasis laid on the need for functional implementation of environmental education in secondary schools curriculum [6].

Despite the fact that a huge amount of money has been spent on Environmental Education awareness programme in schools, the resultant implementation has not been encouraging. The motives of the Educationist and Environmentalist are divided on what constitute Environmental Education individually in all schools rather than making it a multidisciplinary approach. It is important to note that the environment plays a vital role in the socio-economic, political and the ecological development for sustainability.
This paper analytically evaluated the formal implementation of environmental education (E.E.) in secondary schools in both Malaysia and Nigeria, based on the academic and social activities in the

selected schools of study. The aim of this study, therefore, was to provide a constructive critical review of those factors that are hindering or opposing the functional implementation of holistic inculcation of environmental education in Malaysian and Nigerians secondary educational systems.

The objectives therefore, were triple in nature. The first compared the content of Environmental Education programs in Malaysian and Nigerian schools, analyzing the difference and possible causes of its non-functionalities in both nations. Secondly, this research compared the tools for implementation in terms of materials, facilities and resource-persons in Malaysia and Nigeria and identified flaws in the initial policy implementation approach, thereby proffering suggested solutions. Third objective compared the elements of relationship between the student and the environmental education activities. These therefore were set to answer the following questions: 1. Are there differences between the facilities used for environmental education in both countries? 2. Is there any difference between the Environmental Education attendance of in-service training in both countries? 3. Which of the schools is making provision of EE news and materials available to the students?

RESEARCH DESIGN AND METHODOLOGY

Data were collected by using professionally-validated questionnaire and direct interviews with secondary school Head Teachers and students from both countries of study. This research was carried out to test some information on the level of implementation of Environmental Education within the schools. The questionnaire and interviews were administered directly within the schools in Malaysia and Nigeria with permission from relevant authorities. Twenty schools were visited from both countries; ten were selected through simple random sampling. The selection of students was limited to those in Forms 3to5 and 20 students were sampled from each class in each school, ten teachers were selected from each school in each country. A total of 600 questionnaires were distributed but only 420 were retrieved. The represented figures of analyzed respondents were derived from the retrieved questionnaires. Data were collected from Government secondary schools in Klang valley, Selangor State, Malaysia and Lagos State in Nigeria.

Questionnaires were organized into 4 sections with sub-sections A to D

Section A: Background information which contains teacher's gender, age, qualifications, marital status and working experience.

Section B: Teachers opinion, interest and commitment to Environmental Education programs were in question.

Section C: Students personal data which focus on their ambition, interest and participation in the school environmental education programs.

Section D: This was design for the school geography teacher. Questions were based on the school strategies and method of implementing Environmental Education.

The Likert Scale was used through the instrument of appraisal scales. The least on the scale was 1 while the highest was 4 hence a range of 1-4 scale was used as follows:

S/N	SCALE	ABBREVIATION
1	Strongly Disagreed	SA
2	Disagreed	D
3	Agreed	A
4	Strongly Agreed	SA

Here the statements of each hypothesis were tested. The principles behind the formulated hypothesis for this research were coined into questions to create information that reveals the respondents attitude, commitment, interest and implementation of Environmental Education in their respective schools. Data were analyzed using Data editor of SPSS version 16 software for windows as illustrated by Abd-Rahim [7]. Basic data as in results were taken into consideration.

RESULTS AND DISCUSSION

Study did show that there were more schools in Malaysia that provide EE newspaper and magazines were provided in Malaysian schools than were in Nigerian schools. More than 50% of the schools studied responded negatively in Malaysia but, about 70% of the schools studied in Nigeria has no provision for EE newspaper and magazines (Table 1).

Moreover, results in Table 2 clearly shown that more than 54% of the schools researched in Malaysia have Environmental Education (EE) display rooms compared to 28 % in Nigeria. So majority of the schools studied for this research in Nigeria lacked basic EE display room. In table 3, more than 50% of the teachers from the schools of study in Malaysia have attended E.E. in–service training while in Nigeria only 40 % have attended the training. It was revealed that all the schools of study in Malaysia have necessary facilities and qualified resource-persons. However, in Nigeria facilities and resource-persons were inadequate (Table 4).

The study revealed that only 12% of the schools studied have necessary facilities in Nigeria compared to Malaysia with 100 percent. Considerable number of teachers agreed that there were major problems in the implementation of Environmental Education.

There were more teachers in Nigeria than in Malaysia, who agreed that the concept of E.E. was difficult to teach due to lack or inadequate facilities and conducive environment, thereby impacting its implementation negatively. The results of the analyses showed that between the adopted techniques of implementation by the schools in Malaysia and Nigeria, Malaysia teachers were more competent in teaching E.E. The techniques of implementation adopted by Malaysia schools were more effective than those of Nigeria and the level of participation in education societies and clubs of teachers in Malaysia and Nigeria differed greatly.

Table 1: This table shows the response from students from Malaysian and Nigerian schools on provision of related news media on environmental education.

QUESTION	VARIABLES	RESPONDENTS				TOTAL	TOTAL
		MALAYSIA	%	NIGERIA	%		%
Provision of EE-related newspapers and magazines in schools	Strongly disagreed	1	0.6	2	1.3	3	1
	Disagreed	76	50.7	103	68.7	179	59.7
	Agreed	63	42	45	30	108	36
	Strongly agreed	10	6.7	-	-	10	3.3
	TOTAL	150	100	150	100	300	100

Sources: Field work 2009.

Table 2: This table summarizes the response of students to display room approach in E.E. implementation.

QUESTION	VARIABLES	RESPONDENTS				TOTAL	TOTAL
		MALAYSIA	%	NIGERIA	%		%
Presence of display Room for EE implementation in school.	Strongly disagreed.	1	0.7	25	16.7	26	8.7
	Disagreed.	68	45.3	83	55.3	151	50.3
	Agreed.	81	54.0	42	28.0	123	41.0
	Strongly agreed.	-		-		-	-
	TOTAL	150		150		300	100

Table 3: This table summarizes the response in-service training in relation to environmental education

QUESTIONS	VARIABLES	RESPONDENTS				TOTAL	TOTAL
		MALAYSIA	%	NIGERIA	%		%
EE-related in-service training for teachers.	Yes	5	50	4	40	9	45
	No	5	50	6	60	11	55
	TOTAL	10	100	10	100	20	100

Sources: Field work 2009.

Table 4: The table shows the availability of necessary facilities and resource-persons.

QUESTIONS	VARIABLES	RESPONDENTS				TOTAL	TOTAL %
		MALAYSIA	%	NIGERIA	%		
Availability of necessary EE facilities and resource-persons	YES	10	100	2	20	12	60
	NO	-	-	8	80	8	40
	TOTAL	10	100	10	100	20	100

Sources: Field work 2009.

REFERENCES

[1] OECD (1973). Environmental education at University level: Paris, Cedex 16. France p. 29.

[2] Lee, N. (1993). Sustainable development in a developing world: Integrating socio-economic appraisal and environmental assessment. Cheltenham: Edward Elgar Publications p. 17.

[3] Editorial magazine (2002). Environment. Vol.44, no. 7.

[4] Tengku Adnan bin Tengku Awang. (2005). Environmental Education in Malaysia 64 Teaching and expanding knowledge in Science. P 1278-9

[5] Adara, O. A. (1973) .Improving the quality and outreach of EE in Nigeria: World council for curriculum development and instruction. Region 2. Jos. Publishers. P. 32.

[6] Kola Olusanya. (2000). Strategies for implementation of EE in schools.

[7] 7. Abd-Rahim Md Nor (2009). Statistical methods in research. Pearson Malaysia Sdn Bhd, Malaysia.

Forecasting of the Malaysian Armed Forces (MAF) Future Capability

Norliza Hussein[1], Norazman Mohamad Nor[2] and Nooh Abu Bakar[3]
Universiti Pertahanan Nasional Malaysia[1, 2]
Universiti Teknologi Malaysia[3]
norliza67@gmail.com[1]

Abstract
Warfare in the 21st century is very uncertain. Military leaders are facing tough decisions on diverse force options required to bring a desired effect in the operational missions they undertake. To create a balanced and affordable force, while satisfying national objectives, defence planning is characterised as having to seek innovation in technologies and from multidimensional challenges and threats, constrained by decreasing budgetary and resources. This balancing act requires careful considerations at all level in capability planning. Forecasting and Planning (F&P) in future force planning are continually evolving and the change is institutionalised in Capability Based Planning (CBP) framework and joint warfare concept, both driven by the strategy of military transformation. Quantitative decisions for optimisation of force structure and weapon mix supported with qualitatitive factors are critical for developing the Malaysian Armed Forces (MAF) future capability. This study investigates the MAF future capability planning and modelling.

Keywords
Planning and Forecasting (F&P), Force options, Capability Based Planning, joint warfare, capability modelling.

INTRODUCTION

Forecasting has evolved planning of the 21st century military capability to continually adopt a proactive strategy. Military 'capability' is defined as 'the ability to achieve its missions within a specified set of operational objectives within a specified time' [1]. Capability Based Planning (CBP) involves a functional analysis of operational requirements. Once the required capability inventory is defined, the most cost effective and efficient options to satisfy the requirements are sought"[2]. CBP is output-oriented that is translated from high-level capability objectives derived from government guidance [3]. Transformation efforts is all about a change process that combines new concepts, capabilities, people and organisations, exploiting them to the nation's advantage [4]. The generic process for developing CBP is shown in Figure 1 [3].

The need for transformation for the MAF was clear following the end of communist insurgency [5]. In 2007, the MAF adopted CBP and produced a joint plan called the Fourth Dimension MAF Capability Plan (4D MAF)[6]. Previous MAF experience in doctrinal change and modernisation was challenged 'with lack of precise guidance as to the equipment, structure and mission' [7]. Decisions made by Ministry of Defence (Mindef) do not reflect defence needs in terms of meeting capability requirements [8].

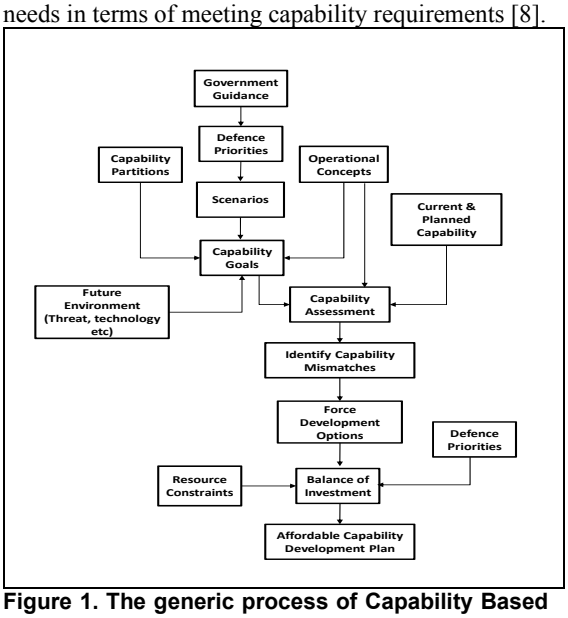


Figure 1. The generic process of Capability Based Planning

LITERATURE REVIEW

Like any other organisation, defence planning is a formal strategic planning for the armed forces. As explained in F&P, future planning belongs to predictive theories of management theories. The characteristics and limitations as well as the process of F&P are described by many [9][10][11][12]. Planning provides inputs to forecasting process. When a planning decision is made explicit, it is clearly a forecast [13].

Complex systems such as defence require a multidisciplinary approach to problem solving. F&P must aim at explaining the past and at predicting the future [9]. Forecasting is dependent on the time frame, the existence of patterns and a number of variables related to the subject under studies [14]. Central to long term planning is support for broad concept development and technology investment in period of 10-25 years through qualitative and subjective analysis based on forecasting and

professional military judgement [15]. Military strategy and policy, capability systems and operational concepts are also the guiding principles for preparing a force for future warfare [16]. Nichiporuk [17] suggests the following trends as variables: geopolitics, demographics, economics, technology, and the environment. Technological innovations and the quantity and quality of the armed forces determined military preparedness to support nation's foreign policies [18]. Makridakis [19] proposes to reconceptualise F&P by using decision-theoretic concepts through a multi-attribute utility frame-work.

Review of F&P methods and techniques used in capability planning is presented. Nichiporuk [17] uses morphological forecasting technique of the Alternative Futures in the US Army Force Planning. Force size, structure and design are based on six alternative futures for the 2025. Complex, adaptive real world problems such as organisational decision making can be modelled and simulated using agent-based modelling (ABM) [20]. ABM, also known as multi agent system or multi agent simulation uses computational modelling that supports hierarchical planning to simulate decision making entities or known as agents and assesses various behavioural patterns they represent within the system or organisation. ABM may combine elements of neural networks, evolutionary programming and game theory. Tangen [21] develops an agent-based constructive simulation to quantitatively assess doctrine together with materiel approaches. He uses life-cycle cost technique to assess cost effectiveness trade-off on future unmanned aerial vehicle design that produces lower cost compared to the evaluation of candidate technologies. Norazman [22] uses a combination of techniques including Quality Function Deployment (QFD), Analytic Hierarchy Process (AHP), Situational Force Scoring (SFS) and Weapon Scoring or Neural Network Perceptron to develop the conceptual model for force structure before a comprehensive mathematical model is developed. Pagotto & Walker [23] use capability engineering to describe the high level process methodology viewed as 'system-of-system'. Strategic guidance is mapped using architectural models to articulate requirements of each capability. Metrics are applied to the models to assess their ability to deliver military capability outcomes through pre-defined tasks and force planning scenario. This work uses programming to forecast the composite mix of force structure and capability systems. Pinder [16] proposes hybrid, interactive, multiple attribute exploratory (HIMAX) processes to support high-level decisions by integrating military experts' opinions. Evaluation on diverse options is compared across a wide spectrum of missions to produce a mix of capabilities. The HIMAX process uses multiple attribute decision making to determine force effectiveness, system and operational characteristics contribution to each attribute and the importance of system characteristics for each system role. Analysis is performed in two time frames; near and far term. Future force planning is prioritised using Analytic Hierarchy Process (AHP).

Within the context of the study, it is important to describe the variables. Analysing the past events, and identifying the issues, lessons and insights provide a better understanding of the present and future trends in defence planning [15]. **Global strategic environment** is assessed both, qualitatively and quantitatively. The Princeton Project on National Security (PPNS) [24] reports that the number of conflicts being fought around the world has declined by some 40 percent since the end of the Cold War and the changing nature of war is that fighting has become more localised. However, current trends reveal complex multidimensional challenges in the future, in terms of globalisation, the rise of emerging powers such as China, India, Russia, Indonesia, South Africa, and Brazil. This increases multi-polarity that may mean a less dominant United States to influence key security issues. The future security interest is also predicted to shift to the Pacific [25]. Non-state actors and challenge to governance as evidenced in Iraq and Afghanistan will persist. Advances in information technology (IT), nanotechnology and biotechnology may found new application in military environment. On the other hand, the ease of transfer expedites by means of globalisation, allow access to previously unavailable technologies and weapons. The ease of use of commercial technology has also exacerbated the problem of proliferation [26].

Future war fighting concept will be a joint operation. Joint warfare concept represents the degree of which, land, sea and air environments are integrated in their operations, structure and process [15][26]. It is implemented based, first, on effects based approach that involves taking a whole-of-nation view of security to find the most appropriate tool to achieve national objectives. Second, is network centric operation which link sensors, engagement systems and decision-makers into an effective and responsive force between internal agencies and also between coalition partners. Network centric warfare (NCW) seeks to provide the future force with the ability to generate tempo, precision and combat power through shared situational awareness, clear procedures, and the information connectivity. The other concept is multi-dimension manoeuvre, which is characterised by tempo, agility, simultaneity, fight asymmetrically, dissimilarity, overmatching at decisive points, deception and surprise, deploying and sustaining forces over great distances [27]. The MAF capability planning and development also discusses **policies**, **current capability** as well as **capability**

partitions. Defence planning of several other countries are also studied.

METHODOLOGY

The study uses mixed model approach, in which both qualitative and quantitative data are collected within a stage or across the stages of the study. The methodology is shown in Figure 2. The preliminary stage is a pre-work that addresses the broad area of the study and draws from it, a specific research problem. This is then used to assist in developing the research proposal before the actual study can take place. In Stage One, the study begins with reviews on literatures from previous works and identifying for the variables.

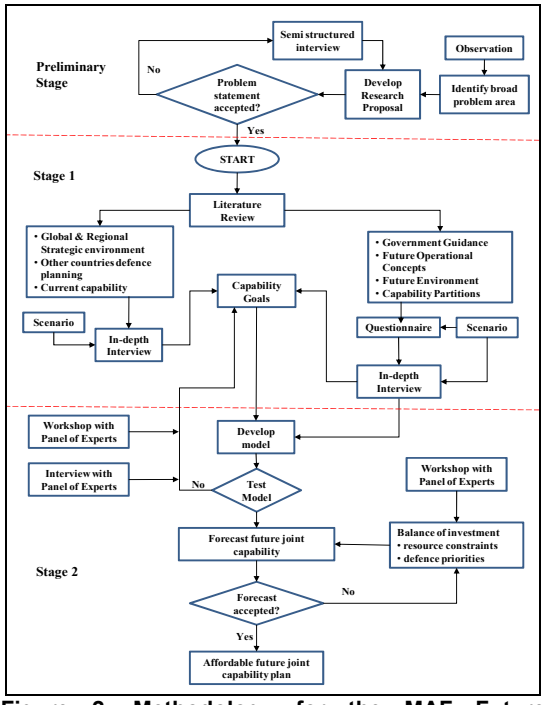


Figure 2. Methodology for the MAF Future Capability

The study progresses with the conduct of survey with planning officers and high level decision makers in Ministry of Defence and the MAF. The purpose is to obtain high level inputs on all listed variables. Guided by plausible scenarios this information provides the required inputs to the capability goals. This is done for two time frames which are the near term (2015-2020) and beyond 2020. Further down, the inputs from defence policies and strategies, future operational concepts, future environment and choices of partitioning the capabilities are obtained from the operational level which involved planners. The feedbacks are channelled as inputs to capability goals.

In Stage Two, the inputs from the MAF capability goals are modelled using multiple attribute decision making technique. The model is tested and if accepted, the next step would be to forecast the MAF future capability using capability prioritisation. If the model is unacceptable, as expected, due to lack of synthesis of the inputs, the panel of experts are convened for individual and group workshops. The data is compiled and compared to achieve a draft capability plan based on the future direction of agreed capability goals. This is then modelled iteratively. The final step in Stage Two is to forecast future capability through prioritisation in two time frames. The same group of expert panels subsequently uses their judgment after the draft capability plan is obtained. Prioritisation takes account on resource constraints, both human capital as well as financial. If the results are acceptable, the forecast of an affordable future joint capability plan for the MAF on two time frames are achieved. The process in Stage Two is also, iterative. This should allow the panel of experts to review the results until a sensible, acceptable and achievable output is obtained.

DATA

Data is a compiled using both, primary and secondary sources. Primary data is gathered through surveys which include face-to-face discussion, telephone conversation, written questionnaire, in-depth interviews and also panel of experts. Survey data are gathered from military and civilian heads that are involved in all or certain aspects of defence planning. Data is also collected from officers in all Planning Branch. In this study, non-probability sampling is used to gather information on planning and other related areas such as technology and security issues. Secondary data is gathered from published unclassified documents such as reports, journal publications, articles in periodicals, books, press statements and websites.

RESULT AND DISCUSSION

There are many works done on capability F&P. The purpose, level, method and techniques however, vary to one another depending on research problems. Like the changing nature of threats, techniques used have also evolved from entirely 'hard' approach to consider rationale behind human decisions. This is particularly the case for military planning. The 4D MAF Capability Plan is the fruit of joint effort by the tri-services. The plan entails that the MAF would be a credible, relevant, and competitive force with multi-role capability and providing effective deterrence to face external challenges in the 21st century [6]. Thus, this requires MAF to be adept in all warfare elements - sub-surface, surface, space and cyberspace. This is a challenge to any organisation, because a joint approach tends to remove stove-pipe planning and focuses planning based on capabilities.

In this study, the author proposes to model and uses panel of experts to capture leaders and planners judgement policy. The purpose is to generate some description of human behaviour and identify the characteristic differences among individuals. A joint

capability with complex and conflicting requirements is generated to predict future decisions. Guided by government guidance, the model is developed to meet the capability goals identified. A mixed model method is proposed to corroborate and validate findings. As planning functions rest with leaders and planners, particularly in Planning Branches, purposive sampling is used. Snowball sampling is used for officers from other units who have knowledge and experience in military planning.

CONCLUSION

The MAF is implementing CBP in a joint approach. The author proposes a mixed method for planning and forecasting using the MAF transformation strategy. Rationale of human decisions in form of qualitative analysis is consolidated in modelling the MAF future capability. This study forecasts the MAF capability for the next ten years. Divided into two time frames, this study is guided consistently by government directives and policies. Prioritisation helps decision makers to bring order in its 5-year term defence planning. Lastly, it is hoped that this forecast will assist decision makers within Mindef and MAF to prepare a credible force for multi-role capability and face the external challenges with resolute confidence and vigour.

REFERENCE

[1] Australian Department of Defence (DoD). *Defence Capability Development Manual 2006.* Document, Canberra: Defence Publishing Servive, 2006.

[2] NATO Research and Technology Board: Panel on Studies, Analysis and Simulation (SAS). "Handbook in Long Term Defense Planning." 2001.

[3] *Guide to Capability-Based Planning.* The Technical Cooperation Program, 2002.

[4] Cebrowski, A. K. "MilitaryTransformation: A Strategic Approach." 2002.

[5] Mohamad Najib, Abdul Razak. *Defending Malaysia: Facing the 21st Century.* London: ASEAN Academic Press Ltd, 2001.

[6] Abdul Aziz, Zainal,. "Perutusan Tahun Baru Panglima Angkatan Tentera (CDF's New Year Message)." 2008.

[7] Cloughley, B. "Malaysia Strains for a Greater World Standing: Incresing Roles for Slimmer Forces." *Jane's International Defence Review*, 1997: 22-25.

[8] Arthur, Gordon. "“Truly Asian!”: The Malaysian Armed Forces." *Asian Military Review*, January 2010: 18-23.

[9] Makridakis, Spyros, Steven C. Wheelwright, and Rob J. Hyndman. *Forecasting: Methods and Applications.* New Jersey: John Wiley & Sons, Inc., 1998.

[10] Thomopoulos, Nick T. *Applied Forecasting Method.* New Jersey: Prentice-Hall, Inc., 1980.

[11] Wildavsky, A. "If Planning is everything, Maybe It's Nothing." *Policy Science* 4 (1973): 127-153.

[12] Alexander, E. R. "If Planning isn't Everything, Maybe It's Something." *The Town Planning Review*, April 1981: 131-142.

[13] Quade, E. S. *Analysis For Public Decisions.* 2. New York: Elsevier science Publishers B.V., 1983.

[14] Taylor III, Bernard W. *Introduction to Management Science.* 9. Pearson International Edition, 2006.

[15] Biemer, Steven M., and Donald J. O'Brien. "An Approach to Joint Warfare Analysis." *John Hopkins APL Technical Digest*, 2000: 203.

[16] Pinder, John D. *Evaluating Future Force Options for the US Army.* Michigan: RAND Graduate School, 2000.

[17] Nichiporuk, Brian. *Alternative Futures and Army Force Planning: Implication for the future force era.* Research, Arroyo Center, RAND Corporation, RAND Corporation, 2005, i-108.

[18] Morgenthau, Hans J. *Politics Among Nations: The Struggle for Power and Peace.* Singapore: McGraw Hill Book Co., 1997.

[19] Makridakis, Spyros G. *Forecasting, Planning, and Strategy for the 21st Century.* New York: The Free Press, 1990.

[20] Bonabeau, Eric. *Agent-based modelling: methods and techniques for simulating human systems.* Colloquium, Procurement National Academy of Sciences, 2002, 7280-7287.

[21] Tangen, Steven Anthony. *A Methodology for the Quantification of Doctrine and Materiel Approaches in Capability-Based Assessment.* Thesis Dissertation, School of Aerospace Engineering, Georgia Institute of Engineering, Georgia Institute of Engineering, 2009.

[22] Norazman, Mohamad Nor. *The Modelling of Defence Structure for Long Term Planning under Financial Constraint* . PhD Thesis, Shrivenham: Cranfield University, 2000.

[23] Pagotto, J.; Walker, R. S.;. *Capability Engineering - Transforming Defence Acquisition in Canada.* Ottawa: Defence R&D Canada, 2004.

[24] The Princeton Project on National Security (PPNS), *Forging a World of Liberty Under Law: U.S. National Security In the 21st Century* (The Woodrow Wilson School of Public and International Affairs, 2006), 51.

[25] Oh, Paul S. "Future Strategic Environment in an era of Persistent Conflict." *Military Review*, July-August 2009: 68-79.

[26] Sloan, Elinor. *The Strategic Capability Investment Plan: Origins, Evolution and Future Prospects* . Ottawa: Canadian Defence and Foreign Affairs Institute, 2006.

[27] Houston, A. G. *Joint Operations for the 21st Century.* Document, Canberra: Defence Publishing Service, 2007.

Essential Characteristics to Integrate Animated Pedagogical Agent (APA) into Problem-Based Learning (PBL) Approach

Rosfatimah Talib[1], Faaizah Shahbodin[2] and Sazilah Salam[3]
Interactive Media Department
Universiti Teknikal Malaysia Melaka (UTeM)
[1]rosy_2309@yahoo.com, [2]faaizah@utem.edu.my, [3]sazilah@utem.edu.my

Abstract
Problem-Based Learning (PBL) and Animated Pedagogical Agent (APA) are two significant contributions to current development in professional education. However, very little empirical research has been conducted to integrate both learning pedagogies. Thus, we conducted a research on integrating APA into PBL environment and this paper discusses mainly on the essential characteristics of an APA to scaffold PBL Approach.

Keywords
Problem-Based Learning (PBL), Animated Pedagogical Agent (APA), Characteristics

INTRODUCTION

PBL is an instructional method that is said to provide student with knowledge suitable for problem solving where learners have full control in their learning process. Learners will become more competent and better able to deal with their working memory limitations besides helping students to understand the subject better.

Although students are demanded to think actively while doing PBL, it is always argued that they still need guidance to support student's thinking process. Besides, [7] report that student surveys revealed that 70% of students in a PBL course found the tutors' roles essential to the success of the method. Therefore, it is clear that the effect of the tutor is one of the important roles in effective PBL and the tutor is well placed to provide scaffolding to learners.

In this research, we integrate APA as a virtual tutor and guided learners through the learning process in PBL. It is also suggested to provide the potential solution to replace the human tutor request in PBL. Thus, we investigate the essential characteristics of an APA to scaffold PBL approach.

PBL CHARACTERISTICS

PBL is an instructional simulation designed to promote easy transfer from learning exercises to real-life problems since the acquisition of new knowledge is integrally link to its application in a single step [3]. It is used by educators from all level to teach their students in more effective way.

The characteristics of PBL include [1]:

i. Lecturer or educator is the cognitive constructivist, curriculum designer and learning coordinator
ii. Problem can be initiative for learning, reflect real life situation, motivate the learning, encourage critical thinking and integrate learning knowledge
iii. Students are main players in small group, cooperative learners, active learners, self-directed learners, knowledge creators and critical thinkers
iv. Tutors are learning facilitators, cognitive coaches and PBL discussion moderators
v. Assessment provides formative progress information and summative assessment

APA CHARACTERISTICS

One of the earliest empirical investigations to the APA literature came from [4] who studied on the impact of pedagogical agent on student's problem solving abilities. There are a number of characteristics that an effective pedagogical agent should display.

i. Motivator
Pedagogical agents should always encourage students to spend more time interacting with the application and attempt more problems besides congratulate users when they successfully solve problems [4].
ii. Emotions
Agent should show that they care about student and their progress by appearing to 'understand' emotions and respond accordingly [2].
iii. Enthusiasm
Whenever the student feels frustrated, the agent should intervene with assistance before the student loses interest and display concern over students' progress that may convince students to take learning seriously [2].
iv. Fun
An agent should also possess a rich and interesting personality, so that it can simply make learning more fun. A student who enjoys a learning environment would undoubtedly spend more time there, which is likely to increase learning [4].
v. Other factors (body language, eye contact, emotional expressions)
Pedagogical agents should be visually expressive to clearly communicate problem-solving advice and simultaneously have a

strong motivational effect on students. Factors such as eye contact, body language and emotional expressions should be modeled and exploited for instructional purposes [5].

INTEGRATING APA INTO PBL ENVIRONMENT

We hypothesize that integrating APA into PBL environment can enhance the scaffolding in conventional PBL. Since students are responsible for acquiring the knowledge to solve the problem in PBL, agent that is integrated into the learning process will be responsible as a tutor or facilitator. Besides, [6] support that these lifelike characters are ideally suited to serve as tutors, coaches, or guides in knowledge-based learning environments.

APA will guide learners on how to solve the problem given by deliver instructional explanations either textually or aurally. Gaze and gesture are used to direct the learners to focus their attention and make the learning experience more effective and enjoyable. Moreover, it is predicted that by supporting students thinking, APA will gradually develop students' capabilities to be more self-dependent while doing PBL.

ESSENTIAL CHARACTERISTICS TO INTEGRATE APA INTO PBL

Results and findings from past researches of PBL and APA have brought a few essential characteristics of APA to scaffold PBL approach in this research. We develop two agents named Madam Linda and Claire to assist learners in a number of ways.

i. Guide and Assist Students

The introduction of APA in PBL is expected to guide and assist students to perform at his/her best during the problem solving activity.

Claire gives step-by-step instructions in every step during problem solving module. She assists learners to the problem solutions by guiding them to explore the materials from 'Learning Resources' to get the answers.

Figure 1. Problem solving activity

ii. Generate/provide explanation

An agent possesses the ability to hold a high proportion of the user's attention and deliver clear advice could even make the students feel the learning process easier.

Claire explains the problem introduction to learners. This will help them to understand more on the problem scenario.

Figure 2. Provide explanation to learners

iii. Motivator

The agent that appears in the background could motivate the users to perform at their best and encourage them to spend more time with the system.

Claire appears in each steps of the problem solving to make them feel that they are not alone in the learning process. This will help to motivate students besides increase their learning performances.

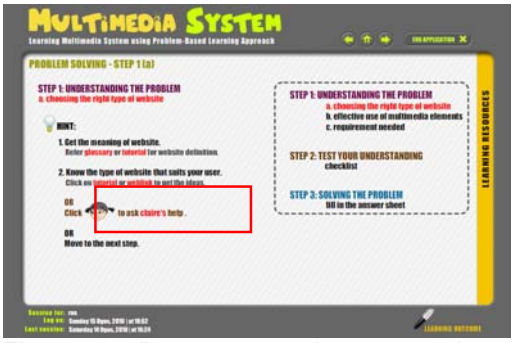


Figure 3. Button 'agent' appears in each steps

iv. Generate Interest

The introduction of APA whose rich and interesting personality should make learning using PBL approach is more interesting and fun.

Agent appears from the beginning of the learning process to attract learner's attention. Madam Linda displays interactions that welcome the user to the system to grab the user's attention at the start of a session.

Figure 4. Madam Linda welcome users

v. Display Non-verbal feedbacks (gaze, gesture and body language)

The agent's interaction and communication could show an understanding of students' emotions, making the users feel that they are not alone in the learning process and that they are 'in things together' with the agent.

The interactions provided by both agents are:

- Default
- Smile
- Move hand
- Speak
- Look
- Blink

PROPOSED RESEARCH PROCEDURE

The test will be carried out in UTeM involving students who take the multimedia system subject in 2010/2011 session.

In first stage, preference test will be assigned to the students. The test consists of 10 questions to find student's preference in choosing the scaffolding type. Then, students will be categorised into two groups (prefer self-learning and prefer guided-learning) according to their preferences from the test.

For the second stage, students from each group will be divided equally into another two groups. First group will use non-APA as scaffolding type while the second group will use APA. Then, pre test which consists of 10 true/false questions and 15 multiple choice questions will be assigned to them.

The third stage will be conducted just after the previous stage. Students need to answer Intrinsic Motivation Inventory (IMI) followed by post-test.

In the final stage, data collected from all test will be analysed to evaluate APA's effectiveness. The score from IMI will be calculated to measure their motivation to the subject while pre and post-test will be analysed using paired sample t-test procedure. Pre and post-test use the same questions except their sequence order. The result will display the significant differences between the variables.

CONCLUSION

APA is integrated into PBL approach to improvise the existing scaffolding in PBL applications. Effective design and the well development of the overall system can increase the quality of learning and may give a strong impact to the learners in a good way. It is hoped that the application can play significant role to motivate the learners as well as to improve their thinking and problem solving skills.

REFERENCES

[1] Chiang A. Integrating Cognitive Agents for Problem-based Learning in an IT Environment. PHD Thesis (2008).

[2] Elliot C., Rickel J. and Lester J. C. Lifelike Pedagogical Agents and Affective Computing: An Exploratory Synthesis. Artificial Intelligence Today, Lecture Notes In Artificial Intelligence (Subseries of Lecture Notes in Computer Science), Special Volume 1600, M. Wooldridge & M. Veloso (Eds.), pp. 195-212, Springer-Verlag, Berlin (1999).

[3] John B. C., What Facilitators do to Make PBL Instruction More Effective Than Normativee Voc-Tech Instruction. Proceedings of International Problem-Based Learning Symposium, University of British Columbia, Canada (2007).

[4] Lester J. C., Converse S. A., Kahler S. E., Barlow T. S., Stone B. A. and Bhogal R. The Persona Effect: Affective Impact of Animated Pedagogical Agents. Proceedings of CHI '97, pp. 359-366, Atlanta (1997).

[5] Lester J. C., Converse S. A., Stone B. A., Kahler S. E. and Barlow T. Animated Pedagogical Agents and Problem-Solving Effectiveness: A Large-Scale Empirical Evaluation. Proceedings of the Eighth World Conference of AIED, pp. 23-30, Japan (1997).

[6] Lester J. C., Stone B. A., Stelling G. D. Lifelike Pedagogical Agents for Mixed-Iniative Problem Solving in Constructivist Learning Environments. Use Modeling and User-Adapted Interaction (1999).

[7] Zimitat C, Hamilton S, DeJersey J, Reilly P, Ward L. Problem-Based Learning in Metabolic Biochemistry (1995).

[8] *http://florey.biosci.uq.edu.au/BiochemEd/PBLmetab.htm*

Problem Solving Steps for Online PBL (Testing Method)

Nurhazirah bt Mohd Bakri[1], Dr.Faaizah Shahbodin[2] and Dr.Hajah Norasiken bt Bakar[3]
[1,2,3]Department of Interactive Media, Faculty of Information Technology and Communication, University Teknikal Malaysia Melaka, Melaka, Malaysia
[1]nurhazirahbakri@yahoo.com, [2]faaizah@utem.edu.my, [3]norasiken@utem.edu.my

Abstract
This paper is discussed about a problem based learning approach where focused on problem solving steps, a middle part of PBL approach. It covers the problem solving steps categories, suggested for detail problem solving steps, difference of instruction and problem solving steps, testing method, and also the element to be assessed in problem solving skill rubric.

Keywords
Problem Based Learning (PBL), Problem Solving Steps.

INTRODUCTION

The project entitled analysis of problem solving steps in an online PBL environment is a project that is conducted to find out the scheme and categorize of problem solving steps. This project also will find out the efficient problem solving steps that can be used in an online PBL environment. PBL is one of learning approached that is widely known nowadays. From a lot of sources that study on PBL, they prove that compared to traditional lecture-based instruction, PBL improves student understanding and retention of ideas, critical thinking, communication and problem-solving skills, as well as the ability of students to adapt their learning to new situations – the cornerstone of lifelong learning [1].

PBL learning involves the use of authentic problems and materials for learning; students in a PBL environment are tasked with applying their knowledge toward developing solutions [9]. As a famous learning approach, PBL have its own tenets. PBL major tenets are [1]:

- Learning and understanding are directly related to the environment or context in which learning occurs.
- Cognitive conflict or puzzlement is the stimulus for learning and determines the organization and nature of what is learned.
- Social environment is primary in providing alternative views and additional information against which we can test the viability of our understanding and comprehension.

Information Technology Security subject (Security in Network subchapter) is chosen as project sample. Based on the result of preliminary analysis, this subtopic is proved as the hardest subtopic among other subtopics in Information Technology Security subject. The product development required investigation of topics such as databases, network security, scripting languages and web site design by using the PBL methods [2]. Cheng and Beumont [3] and Uden and Beumont [4] in their papers also proved that Security in Network can be considered as a relevant topic for PBL approach [5]. The mean of difficult topics in Information Technology Security from the questionnaire result is showed in the Table 1 below:

Table 1. Mean of Difficult Topic – Questionnaire Result (Likert skill: 1-easiest, 4-hardest)

Chapter	Means
Introduction to Information Security	1.73
Authentication and Basic Cryptography	2.36
Program Security	2.45
Operating System Security	2.75
Database Security	2.82
Security in Networks	2.84
Security in Applications	2.77
Wireless Security	2.80
Legal and Ethical Issues in Computer Security	2.27
Cyberlaws	2.27

Current research in PBL grew out of the need to create a workforce that was able to solve problems in any given situation, and utilize critical thinking skills [6]. By using the PBL approach, the product of university is believed to fulfill the industrial requirements with better personnel characteristics.

PBL emphasize self-directed learning means students must engage and move through learning with a high degree of accountability which also means the planning and managing aspects of instruction may have a greater portion of the teachers' time [7]. Harrison suggested the general steps to follow in PBL as below:

- Identify, consistent with the learning objectives of your lesson or topic, potential "problems" for work in the class setting

- Brainstorm a possible "problem" that will illuminate the concept within that application or setting.
- Select at least one "real-world" application or setting for that concept
- Ensure the problem scope and focus is conformed to the scope and nature of effective PBL problems as described below
- Further develop one problem for the envisioned class
- Structure the problem, including the initial and essential questions that will induce students to discuss the issue.
- Identify potential "chunking" of the problem to allow it to unfold in the time available for its work.

PROBLEM SOLVING STEPS

There are many segments that build PBL approach such as problem scenario, problem statement, and assessment. But the central point of this research is problem solving steps. Problem solving is a complex and high order of ability and fundamental capability that have to be pursued and evaluated in education in any academic subjects which have common processes such as problem finding, hypothesis and plan for problem solving, experiment or carrying out problem solving, results and evaluation [8].

This segment is built to improve student problem solving skills and guide students in solving the problem scenario. So, in previous PBL project, there are a lot of problem solving steps that have been build but based to FILA. FILA is the general solving steps used in PBL approach. FILA is stand for facts, ideas, learning issues and actions.

After some review on previous problem solving steps in previous research of PBL, study have come out with two categories; detail problem solving steps and simple problem solving steps. Both category of problem solving steps is distinguished by the number of steps, actions steps, task distribution, seeking information steps, collecting information step where students gather and share their research, analyzing step, and the last step is solution step as shown the Table 2 below:

Table 2. Two main category of problem solving steps in PBL approach.

Category	Detail	Simple
No. of steps	More than 6	Less than 6
Actions	Prepare detail actions to students.	Students need to find actions themselves
Tasks distribution	Ask students to distribute tasks.	Depend on students.
Seeking information	There is a research step.	Depend on students.
Collecting information	Students gather and share info.	It is not stated in steps.
Analyzing	Students analyze the info.	It is not stated in steps.
Solution	The solution step is stated.	Students are asked for solution in instruction.

This project is focused on categories of problem solving steps in PBL. From the study, two category of problem solving steps is produced. The first category is detail problem solving steps and the second category is simple problem solving steps. For simple solving steps, we used FILA solving steps. While for detail problem solving steps, a new solving steps is produced for the project. It consist nine steps and is named as OPSS that stand for Online PBL Solving Steps. These solving steps are produced to be used in PBL online learning environment. Table 3 below shows the steps consisted by OPSS:

Table 3. Online PBL Solving Steps (OPSS).

Steps	Explanation
Problem	Find out the fact of the problem, and any words that need to be taken into consideration.
Ideas	List out ideas of the problem scenario. The ideas can be relate with the previous experiences.
Learning Issues	List out the learning issues from the problem scenario. Relate the issues with the Network Security topic.
Actions	Suggest the proper actions that need to be done in order to solve the problem.
Divide	Divide the actions that need to be conducted with group members.
Research	Conduct individual research based on the given actions. Collect as much as information that can aid group in finding the solution.
Gather	Share the gathered info from the research with other group members.
Analyse	Analyse the gathered information. Relate the gathered info with problem scenario and Security in Network.
Solution	Come out with a relevant and best solution from your analysis.

Instructions and Problem Solving Steps

While doing the research, some confusion in distinguishing the instruction and problem solving steps had occur. What are the differences between the instruction and problem solving steps and why both of them are needed in a PBL project? This study also answers these questions. Instruction is a part in every learning program including PBL. Instruction is needed because:

- To help the learners learn
- Guide them on using the stand alone or online learning program
- To make the learning easier
- To guide students follow the rules of learning approach that is used.

Instruction is an important part of every learning project generally. While problem solving steps is a part of PBL approach. The problem solving steps guide students to solve the problem scenario which is one important element of PBL. It helps students to produce the answer or solution in the form of PBL. It also hoped to improved students' solving skills as their lifelong learning impact.

TESTING METHOD

Testing will be done to find the answer of two research questions. The first question is to find out which approach is better for Information Technology Security teaching and learning. While the second question is to find out either the detail problem solving steps or simple problem solving steps is more effective in online PBL environment and Information Technology Security subject.

Target users for this project are university students that enroll Information Technology Security subject. These students are from Faculty of Information and Communication Technology (FICT) from UTeM. They are in their fifth semester, third year students.

A prototype called ITPBL portal is built by using Claroline template, a freeware and open source LMS. Besides, Claroline is customizable and flexible working environment. It is famous among universities, schools and other training centers as their portal. This template is used extensively at FICT in eFTMK portal as a platform for lecturers to distribute their notes. They also used the faculty portal to give tests and assignments to students. So, students in UTeM are familiar with this template.

This project has occupied 94 students of FICT. At the early stage of the project, these students are given the pre test. Result of the pre test will be assessed to find out the prior knowledge of students in "Security in Network". After that, they are divided into two main groups. First group consists of 40 students will learn in conventional learning approach where there are lecturers that will give a talk about the chapter scaffold with lecture slides in a lecture hall. This group is known as conventional group.

The second group will learn using the ITPBL portal have been developed using PBL approach. This group is known as PBL group consists of 54 students. The PBL group is divided into another two groups with balanced level of students. Each group has 27 students. The first group is known as OPSS group while the second group is known as FILA group. Their named is based on which kind of problem solving steps will they used in the portal. Both groups are divided into other small groups with three people in each group. There will be nine groups for OPSS and FILA group. Overall, there are 18 small groups in PBL group. For a group of students, they consist of one high level student and low level students. Each group combination is in well coordinated.

These PBL group will learn using the ITPBL portal. All of the students that involve in the portal already being registered and grouped. So, they will enter the portal by using their students' number and default password that have been assigned to them. These students will follow the instruction on how to use the portal.

FILA group and OPSS group will use two different session. Both sessions contain similar contents but they are difference in assignment module. In the assignment module, students are prepared with different problem solving steps. One session uses the OPSS steps while the other session uses the FILA steps. When they have completed their assignments, these PBL group will be assessed using the problem solving skill rubric. The answer of students' assignment will be assessed based on their achievement and how close their answer compared to the answer scheme. The performance area to assess students' problem solving skills is showed in the Table 4 below:

Table 4. Problem Solving Skill Rubric

Performance Area to Assess Students	
1.	Defining the problem
2.	Integration of knowledge and ideas
3.	Defining the learning Issues
4.	Developing Actions
5.	Distribute Tasks
6.	Seeking information
7.	Collecting information
8.	Analyzing findings
9.	Solving the problem
10.	Problem solving steps completion

After that, both PBL group and conventional group will be given the post-test. This post-test is used to find out students' performance after both learning approach. The overall flow of the testing method is show in the Figure 1 below:

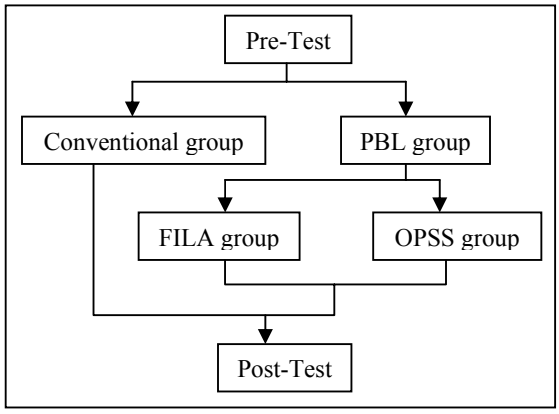


Figure 1. The Flow of the Testing Method

CONCLUSION

The education sectors changed in line with the other sectors in the world. PBL approach becomes one of the favorable learning approaches nowadays. More and more research is done to achieve the perfection in PBL area. Sometimes it is really intricate to convert current learning style to the PBL approach since there are already modules and formats in practice. But, for the sake of students and education better future, something needs to be changed from now.

ACKNOWLEDGEMENT

I am heartily thankful to my supervisor, Dr. Faaizah Shahbodin and my co-supervisor, Dr. Hjh. Norasiken bt Hj. Bakar, whose encouragement, guidance and support from the initial to the final this paper writing stage enabled me to develop an understanding of the subject matter.

Lastly, I offer my regards and blessings to all of those who supported me in any respect during the completion of the paper.

REFERENCES

[1] N. Massa, R. Audet, J. Donnelly, F. Hanes, & M. Kehrhahn. (2007). "PHOTON PBL: Problem-Based Learning in Photonics Technology Education" in http://spie.org/etop/2007/etop07methods1.pdf

[2] D. Delaney & G. G. Mitchell. (2003). "PBL applied to software engineering group projects", Department of Computer Science, National University of Ireland, Maynooth, Ireland.

[3] C.S. Cheng & C. Beumont. (2004). "Evaluating the effectiveness of ICT to support globally distributed PBL teams"

[4] L. Uden & C. Beaumont. (2006). "Technology and Problem-Based Learning," Published by Idea Group Inc. ISBN: 1-59140-744-3, pp. 136

[5] N.M. Bakri, F. Shahbodin, and N. Bakar. (2010). Problem solving steps in online PBL: Research framework. Information Technology Symposium. 2155-897.

[6] T.K. Neo, & M. Neo, (2005). "Engaging students in problem-based learning (PBL) in Malaysian classroom – A constructivist approach". International Conference on Problem-Based Learning 9-11 June 2005, Lahti, Finland.

[7] B. Harrison. (2007). What is Problem-Based Learning?. Sierra Training Associates, Inc.

[8] J.H. Kim. (2007). Key Competencies Needed for Future in the Republic of Korea – Problem Solving Ability: Ability to Integrate. International Symposium on Educational Testing Institute CRET. Korea Institute of Curriculum & Evaluation.

[9] V.P. Dennen. (2000). Task Structuring for On-line Problem Based Learning: A Case Study. Educational Technology and Society 3(3). ISSN 1436-4522.

Challenges Experienced By Malaysian Postgraduate Candidates Prior To Their Sojourn to Australia

Siti Salina Abdullah
Department of Psychology Counseling, Faculty of Management and Economics
University Malaysia Terengganu, 21030 Kuala Terengganu, Terengganu Malaysia
ctsalina@umt.edu.my

Abstract
The aim of this study was to highlight the experiences and challenges the Malaysian postgraduate candidates faced prior to their sojourn to Australia. Respondents were thirteen Malays Muslim postgraduate candidates (nine females, and four males) studying in universities in South Australia, Australia. Malaysian postgraduate candidates here refer to Malaysian candidates who were pursue their master degree or PhD at universities in South Australia. Those Malaysian candidates who were involved in this study were Malay ethnic and Muslim. The result revealed that these students choose Australia as a place for study based on expertise in study areas, courses offered as well as information from existing Malaysian students in Australia.

Keywords
International students, Malay Muslim postgraduate students.

INTERNATIONAL STUDENTS IN AUSTRALIA

Australia is a unique country, as it represents one of the English native countries as well as developed nations outside of Europe and North America. In terms of its geographic location, Australia is the nearest English native country for some Asian countries such as Indonesia, Malaysia and Singapore. In comparison with the US and the UK, Australia is regarded as the third largest country of international students' enrolment.

Internalisation in Australian higher education sectors began in 1951when Australia was involved in the Colombo Plan for Co-operative Development in the South and South East (Back, Davis, & Olsen, 1996). It was based on aid or assisting international students to further their studies in Australia. Meanwhile in the late 1970's, international education was still seen as aid assistance however the focus was market based and financial factors were followed by the commencement of 'Overseas Student Policy' in 1985. Since then, Australia has increased their focus on internationalisation as an important issue for universities (Meiras, 2004).

There are a large number of international students studying at Australian colleges and universities, and the numbers are increasing. In 2008, Australia hosted a record high of over 500,000 overseas students, with a growth of 20.7% from the previous year. The enrolments were recorded by students from more than 190 countries studying at learning institutions in Australia, where more than 75% of enrolled international students came from Asia, followed by increasing numbers from the Middle East, South America and Africa. Overall, in the year 2008, international students' enrolments in Australia came from the following countries: China (127, 276); India (97,035); Republic of Korea (35,376); Thailand (22,278); Malaysia (21,134); Nepal (18,063); Hong Kong (18,012); Indonesia (16,063); Brazil (16,028); and Vietnam (15,931)(Australian Education International, 2009).

The total of overseas or international students from Asia has increased over the past twenty years. It has been identified that due to the change in social and economic policies in Asian countries, the number of Asian students studying in Australia over the past two decades has changed (ABS, 2007). In 1985, five of the top ten countries of residence of students arriving in Australia for education purposes were Malaysia, Indonesia and Singapore (South East Asia); Hong Kong and Japan (North East Asia.). Ten years later, China represented 17% of international students in Australia while others were South Korea (8%), Japan (7%) and Malaysia (6%).

METHODOLOGY

In this study a total of thirteen Malaysian postgraduate students participated in an individual interview, nine females and four males (Table 1). All participants were Malay, studying at universities in South Australia and ranged in age from 27 to 42 years. The length of their stay in South Australia ranged from six months and three years of stay. The majority of the participants were undertaking PhD programme, while were others doing their Masters degree. All students were married and sponsored by the Malaysian Government.

We followed the thematic analysis procedures (Braun & Clarke, 2006) that enables the identification analysis and reporting pattern (themes) within data. Initially, interview transcripts were read several times in their entirety to capture the full content of the participants' narratives. Segments of the interviews were then identified as meaning units and summarised into property statements closely reflecting the language of the participants. These involved five

phases which are; familiarizing with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing the report.

Table 1. Demographic Characteristics of Participants

Code	Age (years)	Sex (M/F)	Length of stay at Australia (months)	Current Courses
S1	42	F	26	PhD
S2	35	M	6	PhD
S3	28	F	6	PhD
S4	34	F	7	Master
S5	35	M	7	PhD
S6	27	F	6	PhD
S7	36	F	42	PhD
S8	34	M	6	Master
S9	33	M	18	Master
S10	40	F	24	PhD
S11	41	F	18	Master
S12	28	F	16	PhD
S13	34	F	12	PhD

Note: S=Student; M=male, F=female

RESULTS

Asked to describe a preparation before further study at Australia, the largest number of respondents identified the reason for choosing Australia as a study destination (Figure 1).

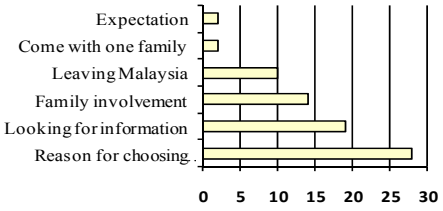


Figure 1. Prior Coming to Australia

There were six items discovered that described the reason these students further their study at Australia: required by their employers, the availability of experts in research area, the only offer received, location, own satisfaction and the course offered. The second majority of response identified was looking for information prior to arriving in Australia. There were two items described: participants did research for information, the use of technology in order to find information. Several responses referred to family involvement in plan to study overseas. This was an interesting response as some participants choose to discuss with their parents, spouse and family members while others decided to disclose only to friends. Other categories of response centred on the issue of leaving Malaysia where two items noticed: participants had mixed feeling and broken heart to leave Malaysia and their families for a while. Finally, some responses focused on the decision to come to Australia with one's family and expectation for a new life in Australia. Details of the participants' responses are described below.

Discussion and Recommendations

The purpose of this study was to investigate the characteristics, needs and expectations of married Malaysian postgraduate students, to examine how these students view the internal and external resources available to them at the time of their arrival in Australia, as well as to explore the types of obstacles they encountered and strategies they used to overcome them. While the majority of research to date has focused on the adjustment of international students in general, this study focused on a sample of married Malaysian postgraduate students studying in Australia, more specifically in South Australia. This study contributes to international students' literature by studying married international students in Australia, a population not widely studied in international student adjustment.

Similar with other researchers (Barker, Child, Gallois, Jones, & Callan, 1991; De Verthelyi, 1995; Novera, 2004), the present study agrees that married postgraduate international students represent a unique perspective for studying their adjustment experience. There is a need to better understand the physiological as well as psychological factors relevant to how these married postgraduate international students cope with study life as well as with family demands. By investigating married Malaysian postgraduate international students in Australia, our study contributes to the postgraduate international students' literature by expanding our understanding of postgraduate international students' issues in particular the Malaysian Muslim cultural context.

This research has highlighted three aspects related to the experience of married Malaysian postgraduate students in the Australian environment, which are the characteristics of Malaysian students prior coming to Australia, the significances of difficulties living in Australia and the strategies used to cope with living in Australia. These aspects are discussed sequentially.

These findings indicated that the main reason which contributed to the participants' journey to Australia was their purpose to Australia itself which consisted of the following six factors: requirements by their employers, expert availability, offers received, location, own satisfaction and the course offered.
The majority of participants reported that they were required by their employers to further their studies overseas. The findings support the objective of the

Malaysian Ministry of Higher Education to ensure that at least 75% of academic staff at public universities and 30% of lecturers in polytechnic and community colleges hold a degree at the Masters level, PhD level or equivalent ("Kementerian Pengajian Tinggi", 2009). Therefore, the majority of the participants in this study were academic staff at Malaysian public universities as they were encouraged by their employers to enhance their academic competencies by improving their academic qualifications. In contrast with other research (Mazzarol & Soutar, 2002), the students' decision to study overseas was influenced by their family, especially their parents. For example, in the case of Taiwanese students, they were forced to study in the USA as many of their parents had relatives in this country. Our findings suggest that this policy needs to be maintained as it will be beneficial for the academic staff at public universities to obtain overseas exposure to enhance their knowledge in their discipline area. Furthermore, it will benefit the universities' productivity as well as the Malaysian government as more research and new findings will be discovered. These result suggests that the Malaysian Ministry of Higher Education works closely with the Australian Embassy in Malaysia, IDP Australia and other agencies to conduct more road shows or to visit Malaysian public universities in order to provide relevant information to potential Malaysian postgraduate internationals, the majority of which are university academic staff.

Consistent with other research (Mazzarol, Kemp, & Savery, 1997; Mazzarol & Soutar, 2002; Shanka, Quintal, & Taylor, 2006), this study agree that location, or geographic proximity also contributes to the international students' decisions to study overseas. For example, Indonesian international students selected Australia as their study destination choice as Australia is one of the closest countries to Indonesia. However, although these Indonesian international students did feel that location was an important factor which contributed to their study destination, it did not apply to most international students (Mazzarol & Soutar, 2002). Nevertheless, for Malaysian postgraduate international students in this study, the location of Australia as the nearest English-speaking country to Malaysia appeared to be an important factor for them. The reason this geographic proximity contributed to the participants' decision was not directly explored in the interviews therefore it is not possible to explain why some participants felt the rationale for this factor.

Other related factors associated with the reasons Malaysian postgraduate international students choose Australia as their study destination are the expert availability and the unique courses offered by Australian universities. These findings are consistent with the research conducted by (Mazzarol, 1998) that highlighted three phases of study destination choices which are: the decision to study overseas, push factors within the home country and pull factors from the potential host country. Mazzarol (1998) stated that staff expertise and a wide variety of courses offered by certain universities were the pull factors for the international students' study decisions. Therefore, our findings suggest that in order to market more international students, Australian universities should offer exclusive packages which include the unique and credible programmes or courses as well as assigning more experts as their academic staff. As participants in this study highlighted these two criteria, it proved that by offering the demanded courses and having the ability of strong staff expertise helps to attract more international students to choose Australia as their study destination.

The second factor which influenced the participants' decisions to study in Australia appears to be a search for information. These findings are consistent with the findings of other research into the push-pull factors influencing international students' destination choice (Mazzarol & Soutar, 2002). According to Mazzarol & Soutar (2002), the selection of study destination choice depends on the amount of information and the students' degree of understanding about a particular host country: the more they know, the more likely they will select it as a study destination.

Therefore, it is understandable and may explain why Malaysian postgraduate international students choose Australia as their study destination as they prepare themselves by searching for relevant information about Australia, universities, courses offered and contact person availability. To assist the potential Malaysian postgraduate students to find more relevant information, our study suggests these students maximize the use of technology such as telephone, Internet, email and blogs and have contact with other Malaysians prior to their arrival in Australia. As mentioned by one participant in this study, the information given by the Malaysian students who are already in Australia helped the participant prepare mentally and physically. Therefore, the technology and information provided by other Malaysians who are already in Australia is helpful in making the searching process easier for these Malaysian postgraduate students.

This study indicated that family involvement is important in the participants' decision making. The value placed on respect to elders by the Malaysian culture (Abdullah, 1996) influences the participants' decision to share their plans with their parents and other family members. In the Malay hierarchical-based society, respect for elders is important as it shows their loyalty to senior elders (orang tua) as wise people who can guide and show them the way

(Abdullah, 1996). Therefore it is understood why the participants involved their family members in their decision making. As Malays saying: "The elders are respected, the young are comforted" (Yang tua dihormati, yang muda di sayangi).

This findings revealed that to avoid future problems, not many participants choose to come separately with their nuclear family to Australia. The finding supports previous research that partners and families can provide social support for international students (Hayes & Lin, 1994; Pedersen, 1991). The findings help to explain the Malay values that are often associated with a sense of interdependence, being cooperative and living in a harmonious relationship (Abdullah, 1996). As Abdullah (1996) explained, peace and harmony in one's surroundings and lives are important for Malays as it relates with collectivism practices among Malays. The Malay sayings of 'United we stand, divided we fall' (Bersatu kita teguh, bercerai kita roboh) and 'The liquid is collective because of the container, opinions become agreeable due to consensus'(Bulat air kerana pembetung, bulat kata kerana muafakat) show the values of harmony and collectivism among Malays. However, due to certain circumstances, two participants had made the decision to live separately from their families for a while before the family arrived in Adelaide.

CONCLUSIONS

Based on this present study, it can be concluded that as international students the Malaysian postgraduate students do face challenges PRIOR TO HTEIR ARRIVAL TO Australia. Challenges can contribute to the students's stressors as it then affect their academic performances as well as their daily lives.

Therefore, it is hoped that the present study will help future Malaysian postgraduate students improve their preparation prior to coming to Australia. Also, the Malaysian government together with the Malaysian Student Department in Australia should facilitate more effort to help these students manage their lives in Australia thus completing their study on time and returning to serve their country.

REFERENCES

[1] Abdullah, A. (1996). *Going glocal: Cultural dimensions in Malaysian management*: Malaysian Institute of Management.

[2] ABS, A. B. o. S. (2007). International Students in Australia. Retrieved 31 March 2007, from http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/66E07209141CE61FCA25732F001C9B8D/$File/41020_International%20students%20in%20Australia_2007.pdf

[3] Atlas of Student Mobility: United Kingdom. (2009). Retrieved 4 December 2009, from http://www.atlas.iienetwork.org/?p=48047

[4] Back, K., Davis, D., & Olsen, A. (1996). *Internationalisation and Higher Education: Goals and Strategies*. Retrieved 22 September 2009. from http://www.dest.gov.au/archive/highered/eippubs/eip9615/front.htm.

[5] Barker, M., Child, C., Gallois, C., Jones, E., & Callan, V. J. (1991). Difficulties of overseas students in social and academic situations. *Australian Journal of Psychology, 43*(2), 79-84.

[6] Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology, 3*(2), 77-101.

[7] Constantine, M. G., Anderson, G. M., Berkel, L. V. A., Caldwell, L. D., & Utsey, S. O. (2005). Examining the cultural adjustment experiences of African international college students: A qualitative analysis. *Journal of counseling psychology, 52*(1), 57-66.

[8] Department of Foreign Affairs and Trade, D. (2009). International Students. Retrieved 20 July 2009, from http://www.dfat.gov.au/aib/tourism_students.html

[9] De Verthelyi, R. F. (1995). International students' spouses: Invisible sojourners in the culture shock literature. *International Journal of Intercultural Relations, 19*(3), 387-411.

[10] Gillard, J. (2009 28 July 2009). International education – its contribution to Australia.

[11] Hayes, R. L., & Lin, H. R. (1994). Coming to America: Developing social support systems for international students. *Journal of Multicultural counseling and Development, 22*, 7-7.

[12] IELTS. (2009). Retrieved 29 December 2009, from http://www.ielts.org

[13] Kagan, H., & Cohen, J. (1990). Cultural adjustment of international students. *Psychological Science, 1*(2), 133-137.

[14] Kementerian Pengajian Tinggi. (2009). Retrieved 14 December 2009, from http://ms.wikipedia.org/wiki/Kementerian_Pengajian_Tinggi_Malaysia

[15] Lee, J. J., & Rice, C. (2007). Welcome to America? International student perceptions of discrimination. *Higher education, 53*(3), 381-409.

[16] Mazzarol, T. (1998). Critical success factors for international education marketing. *International Journal of Educational Management, 12*(4), 163-175.

[17] Mazzarol, T., Kemp, S., & Savery, L. (1997). International students who choose not to study in Australia: An examination of Taiwan and Indonesia. *Australian International Education Foundation, Canberrra*.

[18] Mazzarol, T., & Soutar, G. N. (2002). Push-pull' factors influencing international student destination choice. *International Journal of Educational Management, 16*(2), 82-90.

[19] McMurthie, B. (2001). Arab Students in US Head Home, Citing Growing Hostility. *Chronicle of Higher Education*.

[20] Meiras, S. (2004). International education in Australian universities: Understandings, dimensions and problems. *Journal of Higher Education Policy and Management, 26*(3), 371-380.

[21] Novera, I. A. (2004). Indonesian postgraduate student studying in Australia: An examination of their academic, social and cultural differences. *International Education Journal, 5*(4), 475-487.

[22] Pedersen, P. B. (1991). Counselling international students. *The Counselling Psychologist, 19*, 10-58.

[23] Shanka, T., Quintal, V., & Taylor, R. (2006). Factors Influencing International Students' Choice of an Education Destination–A Correspondence Analysis. *Journal of Marketing for Higher Education, 15*(2), 31-46.

[24] TOEFL. (2009). Retrieved 29 December 2009, from http://www.ets.org

[25] US, I. S. i. t. (2009). International Students on US Campuses at all-time high. Retrieved 29 December, 2009, from http://opendoors.iienetwork.org/?p=131590

A Pattern Based Approach for the Derivation of Base Forms of Verbs from Participles and Tenses for Flexible NLP

Ram Gopal Raj*, S. Abdul-Kareem
Department of Artificial Intelligence, Faculty of Computer Science and Information Technology,
University of Malaya, 50603 Kuala Lumpur.
* gopalraj@tm.net.my

Abstract
Natural Language Processing (NLP) is an integral part of a conversation and by proxy an integral part of a chatterbot. Building a complete vocabulary for a chatterbot is a prohibitively time and effort intensive endeavor and thus makes a learning chatterbot a much more efficient alternative. Learning can be performed from many facets including individual words to phrases and concepts. From the perspective of words, the grammatical parts of speech become important since they allow meaning and structure to be derived from a sentence. Verbs tend to be unique since they have different forms, namely participles and tenses. As such we present an algorithm to derive the base verb from any participle or tense.

Keywords
Tense, participle, pattern.

INTRODUCTION

During the development of our self-learning tele-text conversational entity, or chatterbot, called RONE, we needed to develop suitable knowledge representation scheme and the appropriate sentence dissemination methods, [1]. Of course, since chatterbots are intended to converse with humans, a suitable form of Natural Language Processing (NLP) needed to be implemented. Other research in NLP as well as machine learning indicates that it is possible to create lexical classes from data sets with some accuracy [2], [3], [4]. Lexical classifications are a technique that accommodates certain critical NLP functions such as word sense disambiguation and parsing which are important in answering questions and information matching [5], [6], [7], [8] and [9] all of which are critical to chatterbots. Lexical classes can be used to form generalizations and take into account the syntax of a sentence as formed by its individual words, [10] and [11], as opposed to purely semantic classes, [12]. When mentioning syntax, parsers and subcategorization represent deep syntactic features, [13], [3], [4] and chunkers and taggers represent shallow syntactic features [2]. However, most lexical classes have to be painstakingly defined manually during system development and as such are rarely very comprehensive. As such, increasing emphasis has been placed on automatic classification and since verbs are generally the main predicates in sentences, verbs are the focus of such systems, [2]. An example of an automatically built lexicon is VALEX, [14].

When getting RONE to converse, it is more efficient to allow RONE to add to its own vocabulary instead of building in everything initially. Utilization of sentence grammar helps the system "understand" a sentence better. When, mentioning vocabulary, and grammar, a system needs to know the parts of speech that each word in the system's vocabulary belongs. As such learning new words requires the derivation or prediction of the part of speech that each new word belongs to. Since conversational ability is reliant on NLP, it would be logical to conclude that advances in conversational system technology would be potentially beneficial to NLP. The importance of verbs in NLP is demonstrated in its usefulness when used in establishing relationships between nouns, [15]. RONE utilizes subject object verb relationships to form an understanding of what the user has said. A natural language text analyzing algorithm was presented by [16]. Part of the algorithm utilized the subject object verb relations of text to extract object oriented modeling elements for their study, but clearly showed the importance and usefulness of such relations.

DETEMINING THE BASE VERB

The primary step in our process is the determination of the base verb. Doing so requires either:

1. Doing nothing if the verb is already in its base state,
2. Converting a participle to the base verb, or
3. Converting a verb tense to the base verb.

When considering the participle or tense, apart from the verb is, whose future tense is 'will' and future participle if 'will be', we observed that no other verb in the English language has a future tense or future participle. All the verbs simply attach the word "will" to their respective base verbs to become future tenses and participles. Sometimes the past participles are formed by adding the verb "was" to the base verb of the intended participle. For example the base verb "run" has a past tense "ran", a past participle of "was running", a present participle of "running", a future tense of "will run" and a future participle of "will be running". Thereby only the base verb, past tense, and present participle need to be determined in the

algorithm.

Non Base Verb Markers

Converting a participle or tense to a base verb involves first determining if the word in question is in fact a not a base verb. Verb participles and tenses are clearly "marked" when looking at the verb backwards. All verb participles in the English Language end with "ing", or "s", and all verb past tenses end with most commonly an "ed". There are some unique cases of verb past tenses ending in "id" or "ade" and etcetera. The complete list is seen in Table 1.

Table 1: Patterns of Participles and Tenses of Verbs

Key: => becomes
! not (EXCEPTION to the rule)
== equals
!= not equals

Sub-Classes (ends with)	Variants (ends with)	Action	Examples
ies	== dies, ties	Remove last character	Ties => tie
	All others	replace last 3 characters with 'y'	Carries => carry
us	none	No action	focus
es	Vowel + consonant + es	Remove last character	Scores = score
	others	Remove last 2 characters	
it	== bit	Add 'e'	Bit => bite
thought		Replace last 5 characters with 'ink'	thought => think
fought		Replace last 5 characters with 'ight'	Fought => fight
sought		Replace last 5 characters with 'eek'	Sought => seek
bought		Replace last 5 characters with 'uy'	Bought => buy
brought		Replace last 5 characters with 'ing'	Brought => bring
Consonant + Sang, Consonant + rang, Consonant + tang, Consonant + wang		Replace last 3 characters with 'ing'	Sang => sing
caught		Replace last 3 characters with 'tch'	Caught => catch
taught		Replace last 4 characters with 'each'	Taught => teach
R +Vowel + wn, s +Vowel + wn, h +Vowel + wn, n +Vowel + wn, l +Vowel + wn	!=Drown, !=clown, !=crown, !=disown, != frown	Remove last character.	Grown => grow
Blew		Replace last 2 characters with 'ow'	Blew => blow
flew		Replace last 2 characters with 'y'	Flew => fly
drew		Replace last 2 characters with 'aw'	Drew => draw
	!=accept	Replace last 3 characters with 'eep'	Kept => keep
Iting, ating, outing, uoting		Replace last 3 characters with 'e'	Uniting => unite
eating	!= eating	Replace last 3 characters with 'e'	Creating => create
others		Remove last 3 characters	Voting => vote
nning		Remove last 4 characters	Running => run
uning, oning, ining, caning		Replace last 3 characters with 'e'	Tuning => tune
others		Remove last 3 characters	Burning => burn
aking	eaking	Remove last 3 characters	Speaking => speak
	others	Replace last 3 characters with 'e'	Shaking => shake
Vowel + consonant + ing		Replace last 3 characters with 'e'	Riding => ride
lving, dging, gling, tling, ching, nging, bling, kling		Replace last 3 characters with 'e'	Sprinkling => sprinkle
others		Remove last 3 characters	Hearing => hear
!dd, !rd, ! ld, !nd, !vowel + d		Remove last character	Heard => hear
Gned, yed, ned, hed	nned	Remove last 3 characters	Banned => ban
	Consonant + Vowel + ned	Remove last character	hydroplaned => hydroplane
	Vowel + Vowel + ned	Remove last 2 characters	Bemeaned => bemean
	ched	Remove last character	Psyched => psych
Led, bed	lled	Remove last 2 characters	Swelled => swell
	bbed	Remove last 3 characters	Stubbed => stub
	Consonant + Vowel + "sub-class"	Remove last character	Prescribed => prescribe
	Vowel + Vowel + "sub-class"	Remove last 2 characters	Pooled => pool
Cked, rked, ssed		Remove last 2 characters	Passed => pass
rred	Vowel + rred	Remove last 3 characters	Inferred => infer
Med	Vowel + med	Remove last character	Timed => time
	mmed	Remove last 3	Crammed =>

		characters	cram
ured		Remove last character	Cured => cure
ied	!died	Replace last 3 characters with 'y'	Unified => unify
red	Ared, ered, ired, ored	Remove last character	Stored => store
	Uired, tred	Remove last character	Acquired => acquire
Tted, dded	!added	Remove last 3 characters	Batted => bat
Vowel + ted	Oated, ooted, eeted, ieted, eited	Remove last 2 characters	Footed => foot
	dited	Remove last 2 characters	Edited => edit
	others	Remove last character	Violated => violate
Ded, ved, ged, sed, ked, zed, wed, !=wed	Vowel + gged	Remove last 3 characters	Drugged => drug
	lked	Remove last 2 characters	Talked => talk
	Vowel + wed	Remove last 2 characters	Gnawed => gnaw
	others	Remove last character	Smoked => smoke
Aid, !=aid		Replace last 2 characters with 'y'	Laid => lay
made		Replace last 2 characters with 'ke'	Made => make
bade		Replace last 3 characters with 'id'	Bade => bid

ALGORITHM USAGE

The patterns seen in Table 1 were implemented in a Java application for testing. The input was checked for the end patterns using "if else" conditions. A list of some 100 000 verbs, [17], was run through using the patterns shown in Table 1. Usage of the patterns is based on the following algorithm, represented in first-order logic, where an input verb (represented by *a*) is compared to the Classification (represented by *x*) and to the Sub-classes (represented by *y*) and to the variant (represented by *z*).

We make the following assumptions. First, that there is at least one verb, *a*, in the English language where pattern *x* occurs.

$$\exists a\ (verb(a) \rightarrow patternOccurs(a,x)) \quad (1)$$

Second, that there is at least one verb, *a*, in the English language where both pattern *x* and pattern *y* occur.

$$\exists a\ (verb(a) \rightarrow patternOccurs\ (a,x)\ \wedge\ patternOccurs\ (a,y)) \quad (2)$$

Third, that there is at least one verb, *a*, in the English language where pattern *x* and pattern *y* and pattern *z* occur.

$$\exists a\ (verb(a) \rightarrow patternOccurs\ (a,x)\ \wedge\ patternOccurs\ (a,y)\ \wedge\ patternOccurs\ (a,z)) \quad (3)$$

Fourth, for all *z*, if the *z* is not specified (blank entry in Table 1) and no other corresponding *z* matched, then *z* is considered to occur in *a*.

$$\forall z_{1,2,3\ldots n}\ ((\neg patternOccurs\ (a,z_{1,2,3\ldots n-1})\ \wedge \neg specified\ (z_n)) \rightarrow patternOccurs\ (a,z)) \quad (4)$$

Fifth, that for all *a* if pattern *x* and pattern *y* and pattern *z* occur, then *e* will not occur.

$$\forall a\ ((\ patternOccurs\ (a,x)\ \wedge\ patternOccurs\ (a,y)\ \wedge\ patternOccurs\ (a,z)) \leftrightarrow \neg patternOccurs(a,e)) \quad (5)$$

Therefore, if *a* falls into a pattern (*x*, *y*, *z*), then the corresponding action (represented by *b*) is taken if and only if any EXCEPTION to the rule (represented by *e*) does not occur.

$$changeVerb\ (a, x, y, z, b, e) = patternOccurs\ (a,x)\ \wedge\ patternOccurs\ (a,y)\ \wedge\ (patternOccurs\ (a,z)\ \vee\ (\neg patternOccurs\ (a,z)\ \wedge \neg specified\ (z)))\ \wedge \neg patternOccurs(a,e) \quad (6)$$

DISCUSSION AND CONCLUSION

Although the tests so far have indicated that any verb can be decomposed correctly into its base state, should any verb be decomposed incorrectly, the correction can be performed by adding another condition to Table 1. An advantage of being able to obtain the base verb is the possibility that synonyms and antonyms of these base verbs are more readily accessible. The usefulness in obtaining the base verb also lies in that once the base verb has been obtained, the participles and tenses can be expanded using a similar technique of end patterns. We are currently working on such an algorithm and will publish our results as soon as we have conclusive results.

REFERENCES

[1] Raj, R.G. and Abdul-Kareem, S. (2009), Information Dissemination And Storage For Tele-Text Based Conversational Systems' Learning. *Malaysian Journal of Computer Science*, 22(2): pp 138-159.

[2] Merlo, P. and Stevenson, S. (2001). Automatic verb classification based on statistical distributions of argument structure. *Computational Linguistics*, 27(3):373–408.

[3] Korhonen, A., Krymolowski, Y., and Collier, N. (2006b). Automatic classification of verbs in biomedical texts. *In Proceedings of the 21st International Conference on Computational Linguistics and the 44th Annual meeting of the ACL*, pages 345–352.

[4] Schulte im Walde, S. (2006). Experiments on the automatic induction of german semantic verb classes. *Computational Linguistics*, 32(2):159–194.

[5] Dorr, B. J. (1997). Large-scale dictionary construction for foreign language tutoring and interlingual machine translation. *Machine Translation*, 12(4):271–322.
[6] Prescher, D., Riezler, S., and Rooth, M. (2000). Using a probabilistic class-based lexicon for lexical ambiguity resolution. In 18th International Conference on Computational Linguistics, pages 649–655, Saarbr¨ucken, Germany.
[7] Swier, R. and Stevenson, S. (2004). Unsupervised semantic role labelling. *In Proceedings of the 2004 Conference on Empirical Methods in Natural Language Processing*, pages 95–102, Barcelona, Spain, August.
[8] Dang, H. T. (2004). *Investigations into the Role of Lexical Semantics in Word Sense Disambiguation*. Ph.D. thesis, CIS, University of Pennsylvania.
[9] Shi, L. and Mihalcea, R. (2005). Putting pieces together: Combining FrameNet, VerbNet and WordNet for robust semantic parsing. In Proceedings of the Sixth International Conference on Intelligent Text Processing and Computational Linguistics, Mexico City, Mexico.
[10] Jackendoff, R. (1990). *Semantic Structures*. MIT Press, Cambridge, Massachusetts.
[11] Levin, B. (1993). *English Verb Classes and Alternations*. Chicago University Press, Chicago.
[12] Miller, G. A. (1990). WordNet: An on-line lexical database. *International Journal of Lexicography*, 3(4):235–312.
[13] Schulte im Walde, S. (2000). Clustering verbs semantically according to their alternation behaviour. *In Proceedings of COLING*, pages 747–753, Saarbr¨ucken, Germany.
[14] Korhonen, A., Krymolowski, Y., and Briscoe, T. (2006a). A large subcategorization lexicon for natural language processing applications. *In Proceedings of LREC*.
[15] Nakov, P. and Hearst, M. (2006), *Using Verbs to Characterize Noun-Noun Relations*. [online] available at: http://biotext.berkeley.edu/papers/aimsa2006.pdf
[16] Bajwa, I.S., Samad, A. and Mumtaz, S. (2009). "Object Oriented Software Modeling Using NLP Based Knowledge Extraction," in *European Journal of Scientific Research*, ISSN 1450-216X Vol.35 No.1 (2009), pp 22-33.
[17] Ward, G. (2002), *mobypos.txt, Moby Word Lists*, Project Gutenberg Literary Archive Foundation, [online] available at: http://www.gutenberg.org/etext/3201

Research Supervision: Success and Failure Factors

Mahathir Mahfordz, Norizan Mohd Yasin
Faculty of Computer Science and Information Technology
University of Malaya, Kuala Lumpur, Malaysia
mrdell_06@yahoo.com, norizan@um.edu.my

Abstract
This research focuses on the current situation of research supervision at the Faculty of Computer Science and Information Technology (FCSIT), University of Malaya (UM). Mixed method approaches were conducted in this study; survey questionnaire and interview which focus on the perspectives view from faculty administration, supervisor and student regarding their experiences throughout the supervision process at FCSIT. Several success and failure factors which affect the research supervision; such as time management, roles of supervisor and student management have been analyzed in fine points. Furthermore, this research enhances the understanding concept and importance of research supervision in postgraduate environment.

Keywords
Research supervision, postgraduate management

INTRODUCTION

Since its inception on September 22, 1994, in keeping with UM motto "The Leader in Research & Innovation", FCSIT strengthen itself with the vision to be an internationally well-known centre of excellence in research and education in Computer Science and Information Technology. As stated in University of Malaya (Master's Degree) Rules and Regulations 2001 and University of Malaya (Degree of Doctor of Philosophy) Rules and Regulation 2007, for the students who enrolled in the programmes of study which consist of dissertation part, e.g: Master's Degree by Coursework and Dissertation, Master's Degree by Dissertation and Doctor of Philosophy, they need to submit the dissertation at the end of their postgraduate candidature as a requirement for the degree completion. The faculty shall appoint at least one supervisor for each student for the research component of the respective degree programmes. (In this study, the term thesis also implies dissertations and special research projects required for graduation.) The research produced by the students keep increasing in numbers from year to year, corresponding the numbers of enrolled postgraduates in FCSIT. Due to the increasing number of students, supervisors are required to supervise more research students than they have in the past. For that reason, various researches have shown several concerns about research supervision, especially in postgraduate environment. Postgraduate supervision would appear to be an international issue [5].

BACKGROUND

The research produced by the students keep increasing in numbers from year to year, corresponding the numbers of enrolled postgraduates in FCSIT. Concern has been increasing in recent years over the proportion of research students who fail to submit a thesis after a period of time. Supervisors and students are not able to meet each other regularly due to the time constraints, hence faculty administration not able to view and manage the overall status of the students' research. Several factors which affect the research supervision environment will be identified in details.

LITERATURE REVIEW

Postgraduate Enrollment

In 2008, the Malaysian government had set a target of producing 60,000 Malaysian PhD holders by 2020 under "MyBrain15" initiative. This initiative was created in order for the country to be competitive, drive innovation and promote economic growth [7]. The data in *Buku Perangkaan Pengajian Tinggi Malaysia 2009* shows that postgraduate admission in Malaysia has gradually increased since 2005 (see Figure 1).

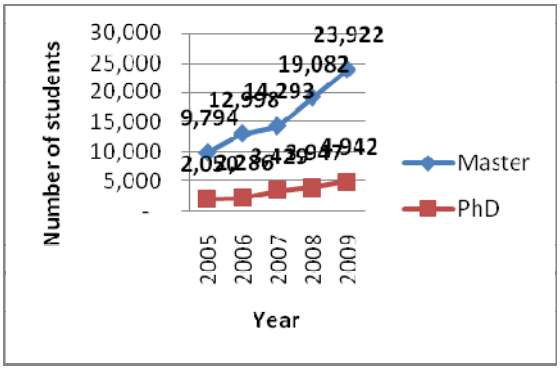


Figure 1. Postgraduate admission in Malaysian higher education institutions

Apart from that, the total numbers of postgraduate admissions have increased in FCSIT as indicated in Table 1. However, from 2004 onwards, the faculty reduced the student's admission in the move to lower the staff to student ratio [3].

Table 1. Total admission of postgraduate students by programmes 1993-2009

Year	Master of Computer Science	Master of Library and Information Science	Master of Software Engineering	Master of Information Technology	Doctor of Philosophy	Total
1993-1996	16	37	0	0	11	**64**
1997	4	18	10	0	1	**33**
1998	32	18	9	0	2	**61**
1999	58	11	8	0	5	**82**
2000	49	21	15	74	9	**168**
2001	52	31	36	66	6	**191**
2002	57	36	64	50	11	**218**
2003	91	39	93	83	18	**324**
2004	84	39	23	48	21	**215**
2005	104	40	24	47	28	**243**
2006	99	23	50	44	19	**235**
2007	106	17	22	65	29	**239**
2008	53	10	19	17	21	**120**
2009	31	36	42	20	34	**163**
Total	**836**	**376**	**415**	**514**	**215**	**2356**

Late Completion

Based on the data in the FCSIT Annual Report 2009 [3], several data estimation has been made. Table 2 shows only twenty to 50% of the PhD students were able to finish their degree on time (8 normal semesters; 4 years) since 2006. Surprisingly, there is nobody who graduated in 2008.

Table 2. Completion percentage of PhD's student

Enrollment year	**2002**	**2003**	**2004**	**2005**
Admission	11	18	21	28
Graduating year	**2006**	**2007**	**2008**	**2009**
Graduated	3	4	0	14
Percentage (%)	27.27	22.22	0	50.00

In master's degree programmes, only forty to 60% of the students manage to graduate on time (4 normal semesters; 2 years) since 2006 (refer to Table 3).

Table 3. Completion percentage of master's degree student

Enrollment year	**2004**	**2005**	**2006**	**2007**
Admission	194	215	216	210
Graduating year	**2006**	**2007**	**2008**	**2009**
Graduated	119	125	88	111
Percentage (%)	61.34	58.14	40.74	52.86

Postgraduates study needs a lot of paperwork and researches to be handed off. Some students may have taken the time limit for granted as they usually starts their researches later than as expected [8]. What they almost did not know was that, the action could cause them delay in obtaining their degree. They usually like to start their research based on A-Z basis, which some of them can be done intermittently on top of one another. Based on a research done by Dillon and Mallot [2], Snell [6], they spend approximately 8-9 months longer than the 1-2 years period to get a master's degree.

RESEARCH METHODOLOGY

Mixed-method approaches were selected in this study; survey questionnaire and interview. Both methods were focused on the perspectives view from faculty administration, supervisor and student itself regarding their experiences throughout the supervision process at FCSIT, management of the research students, success and failure factors which affect the thesis completion, and impacts of supervision on postgraduate output.

DATA ANALYSIS AND FINDINGS

Analysis of the data collected indicates nearly every supervisor currently supervises 5 to 15 students. There is a supervisor who supervises more than 20 students as well. Most of the supervisors were prepared logbook or folder for each student to keep their students' research record. Surprisingly, there is a supervisor did not keep the students' research record. Most supervisors allocated specific consultation hours for their students; either once per week or two to three times per month. Sometimes it could be more depends on the student commitment and supervisor requirement.

A number of students mentioned that it is too hard to make an appointment with their supervisor and last minute cancellation of an appointment is the other problem that being faced. It shows that students and supervisors are not able to meet each other regularly due to the problems arise. Sometimes supervisors have to attend seminars, meetings or conferences which took longer time; without leaving any announcement or notice to the students. When students were not able to meet their supervisors frequently, they will have negative feeling to the supervisor throughout the research supervision process.

Currently, the management of FCSIT does not keep track the supervision process between the supervisor and their students. They just refer to the progress report that has been prepared by the students at the end of each semester. That was the only way the faculty keep contact with the students. When students do not submit the progress report or the faculty do not satisfied with the progress report, the administration will send the unsatisfactory letter to the students.
Majority of the respondents suggested that the management of FCSIT should keep track and aware with the current situation of supervision process in this faculty.

DISCUSSION

Time Management

Studying a postgraduate degree need a very good time management. Most of the time would not be in classes like primary or secondary schools but they are more of paperwork, meeting and field work. Having their own sweet time, they are tempted to get part-time jobs. Thus, they assume that researches can be completed later [4]. What they did not realized is that the time taken is not as short as it seems and having to do two things at the same time- work and study might not be as suitable for those who do not have a proper time management. Worst even, the students only register their courses just to make sure they are still 'active' the program as such but their priority might just have diverted to the workplace or their part time jobs.

For part-time students, they had difficulties to divide time properly between working responsibilities and complete the research at the same time. With the heavy loads in working place, they try to meet the supervisor frequently. As the part-time students said, *"When I came to the faculty, my supervisor had urgent things to do, so then the appointment will get cancel all of a sudden"*, and *"My supervisor has many students. I have to queue during consultation hour and wait more than one hour outside my supervisor's room. Sometimes I only manage to communicate with my supervisor around 10-15 minutes only."*

Roles of Supervisor

There are many ways that the supervisors tried in order to keep contact with their students. Most of the supervisors will send the reminder email and message through phone (Short Messaging System-SMS). Apart from that, they will give a motivational support and extra guidance to encourage the students to perform well in their research journey.

Experienced supervisor can guide everything for the students. On the other hand, new supervisor just can guide the way, since they want to gain more experience on research supervision process. Most of the supervisors allocated specific time during consultation hour for each student every weeks. Student must take this opportunity to meet and discuss their current research progress with them.

Supervisor will enjoy when the students make progress very well and show the best attitude during the supervision process. Furthermore, it will give a great contribution to the research and supervision process will become much easier. On the other hand, supervisor will not enjoy when the students difficult to focus on their research work; especially for part-time students. Research process will get interrupted when both parties were burdened with loads of respective work.

Other than that, higher expectation from the supervisor also contributes to the positive and negative impact to the research process. Some students while they can accept the challenges from their supervisor, on the other hand they can feel down towards the end of the research completion. Supervisor should keep in touch with the students. If they not an expert in the certain research area, they can help to find other experts by introduce to the related sources.

Every supervisor must have a target for the research completion rates of their students, especially for those who has many students under their supervision. They should target at least 50% of their students complete their research on time, hence enhancing the supervision process.

Emotional Feeling

Other than that, the researcher (student) itself should push themselves to manage their research process properly. Up and down of the research is common nowadays; it is related to human factor. Personal problems can interrupt student emotion. So the students must live in the community; which means discipline them to complete their research on time. They should create and participate in the research community, especially in their specialized research area.

Feedback

Most of the students faced the difficulties to get the feedbacks from their supervisor regarding their research progress. When students submitted the research report or chapter by chapter, it took almost 2-3 weeks to get a feedback from their supervisor. Students will feel not comfortable when the supervisor gives many excuses when they keep pushing them for the feedbacks. **Some students were fully dependent on their supervisor and not being active as well. They failed to manage their time properly and keep asking *"What should I do?"***

Research Group

Students may create a research group with the guidance from the supervisors. From the development of the research group, students can share their knowledge and help each other. This action will enhance the research culture in this faculty.

Student Management

The management of FCSIT should keep track and aware with the current situation of supervision process in this faculty. Currently, they just refer to the

progress report that has been prepared by the students in the early of each semester. Other than that, the faculty should provide enough research facilities such as photostat centre, computer equipments, research labs, and comfortable working space for the students.

CONCLUSION

Several aspects of research supervision have been discussed in this paper. With the growing numbers of postgraduate enrollment, research supervision has become a challenging task for the supervisor. Supervisor and student must 'lend a hand' between each other to make sure the successful journey of the research completion. Good relationship between supervisor and students during the whole journey of the research supervision process will ensure the greater impacts to the research quality and completion time.

ACKNOWLEDGMENTS

Deepest appreciation goes to the Government of Malaysia, Majlis Amanah Rakyat (MARA) and Institute of Research Management and Monitoring (IPPP), University of Malaya who gave financial support which had made this research easier. Not forgotten to the respondents involved in the data collection process for their cooperation and willingness to participate in this research.

REFERENCES

[1] Buku Perangkaan Pengajian Tinggi Malaysia 2009, Kementerian Pengajian Tinggi Malaysia.

[2] Dillon, M. J., & Malott, R. W., Supervising master's theses and doctoral dissertations. *Teaching of Psychology, 8*(4), (1981), 195-202.

[3] FCSIT Annual Report 2009, Faculty of Computer Science and Information Technology, University of Malaya.

[4] Garcia, M. E., *Preventing the "All But Thesis" phenomenon.* (Doctoral dissertation, Western Michigan University at Kalamazoo, Michigan, 1987).

[5] Pearson, M., Evans, T., & Macauley, P., 'Editorial: The working life of doctoral students: Challenges for research education and training', *Studies in Continuing Education*, vol. 26, (2004), 347–352.

[6] Snell, J. L., The master's degree. In E. Walters (Ed.), *Graduate education today.* Washington, DC: American Council of Education, (1965).

[7] The Star, 26 September 2008.

[8] Wilson, K. M., *Of time and the doctorate.* Atlanta, GA: Southern Regional Education Board, (1965).

ORAL

SCIENCE AND TECHNOLOGY

Building Maintenance Practice: Initial Findings

Olanrewaju Abdul Lateef A, Mohd Faris Khamidi and Arazi Idrus
Department of Civil Engineering, Universiti Teknologi PETRONAS
Bandar Seri Iskandar 31750 Tronoh, Perak Darul Ridzuan
Correspondence: abdullateef.olanrewaju@ymail.com

Abstract
This paper reports part of an ongoing research on the development of systemic maintenance management model for Malaysian universities campuses. Building requires maintenance in order to contribute to organization corporate mission and vision. However, to obtain value for money invested, maintenance management requires multi-disciplinary approach in order to be systemic. The prime objective of this paper is to investigate building maintenance practices and applications. In order to achieve the set objective, the paper relied on literature review and questionnaire survey. The results show that reactive maintenance is the most likely practice that could lead to poor service delivery.

Keywords
university building; maintenance practices; implications; Malaysia

INTRODUCTION

Malaysian quest to attain high-income status by 2020 involves intensive transformation of the economic structure. However, in order to achieve this, the supply and availability of market driven workforce is prominent. In order to produce graduates that the market wants, there is the need for functional university. In order words, the assets of the university must be in optimum operable performance. In this regards, building which is the second most significant asset of the university apart from the human asset must be in optimum performance standard at all time.

University buildings are procured to create and sustain enabling environment to support learning, teaching, researches and innovations. While new buildings are desirable, it is not possible for building to remain new throughout their design lives. Yet, is it not possible to replace, reconstruct or even refurbish all the university's buildings at one time. Thus, the need for maintenance will only intensive. This paper investigates building maintenance by enumerating the various maintenance practices and their implications. In order to achieve the set objectives, the paper combined literature review with questionnaire survey. Data obtained is analyzed with SPPS

RESEARCH DESIGN

A postal questionnaire survey approach was used to collect primary data. The questionnaire was addressed to senior staff in the maintenance organizations. The questionnaires were administered on 50 recognized universities in Malaysia. The sample size was initially drawn from a published data based of the Ministry of Higher Education, but supplemented with information from the media (national newspapers) and catalogues. This is necessary as data from the MOHE were not current. Data analysis was performed using SPSS to produce statistics. The data collection span through four months.

LITERATURE REVIEW AND BACKGROUND

Building maintenance has been defined differently by different researchers and authors. In this paper, maintenance it is defined as all the require tasks undertaken in order to preserve, repair, protect and care for a building's structure and form after completion or after any repair or replacement to current standards to enable it to serves its intended functions throughout its entire life span [1]. The maintenance of buildings ranges from minor works that cost small sums of money to major works that run into billions. Empirical studies have suggested that maintenance of the university buildings in Malaysia is corrective, routine or preventive [1].

However, building maintenance strategies, whether corrective, preventive, predictive or proactive are most likely to be budget driven, and adhere to cultured of fragmentation and correction. In order words, maintenance is not initiated according to building performance. But it is dictated by financial priorities decided at a specific time together with the identification of defects in the buildings. While proactive maintenance can be an effective approach to maintenance management [4 and 5], it is critical for maintenance to be initiated on the basis of value of the building to the occupiers.

This justification is reasonable and appropriate because buildings are capital goods. In other words, buildings are not wanted for their own sake, but for the services they provide to the building users. Buildings occupiers often judged a maintenance services directly on how it affect them rather than on the actually quality of the repair [6 and 7].The conditional based is initiated in response to deterioration in buildings.

Therefore, it is not a proactive approach to maintenance; it is also reactive because it depends on the existence of "sickness" of the building before "treatment" is recommended.

However, what is critical to the users of a building is the ability of the building to support the performance of the activities within the building and not necessarily the physical condition of the building per se ([2]. In addition, the volumes of works that arise as a result of stock condition survey are in most cases greater than the budgets which also introduces another complex judgment that is involves in setting priority. The physical of the building is just a symptom not a cause.

At best what a condition based policy is to return the building to its original condition not to improve it value. Value of building is more than just the condition of building. Although, preventive maintenance could avoid or reduce the unscheduled down time and costly repair associated with corrective maintenance, but is often schedule more than it is required [3]. Thus introducing costs that are in some extent are not required and therefore should be minimized without comprising the building performance. Details of the shortcomings of these maintenance practices can be found in Olanrewaju [1].

DATA ANALYSIS, RESULTS AND DISCUSSION

A total of 50 questionnaires were sent out to the maintenance organizations of universities. 33 questionnaires were returned and analyzed for this study. This represents 66% response rate. This is an excellent response rate for a postal questionnaire [8]. Analysis of the outcome of the survey shows that most (50%) of the respondents of the respondents possessed Bachelor degree and 21.9% had obtained MSc degrees. The survey revealed that most (32%) of the respondents were actually maintenance managers while about 19% were facilities managers. More than 50% of the respondents have more than 5years industrial experience. These backgrounds provide the respondents with wide experience capable of providing independent and unbiased opinion on information that were addressed to them.

The section that followed presents the results of the survey on the effects of the maintenance management practices. The level or degree of effects of each of the maintenance systems were measured on three criteria against scale of: strongly disagree (1), disagree (2), somehow disagree (3), agree (4) and strongly agree (5). The results of the data analysis were contains in Table 1. Corrective maintenance, with mean score of 2.94 is the mostly like practice that could lead to poor service delivery. In other words, corrective maintenance will more than other practices lead to unnecessary increase in maintenance costs, poor users' satisfactions and increase in maintenance backlogs.

The results also show that routine or cyclical maintenance is the least practice that leads to the above enumerated vices. In summary, none of the practices is without faults. These outcomes are however not surprising a bit, because maintenance as concept and term us tactical. Therefore a generic solution in order to improve building performance, increase users' satisfactions and increase productivity rest in the development of a supporting structure that could facilitate decision making process. In other words, maintenance should be positively plan, strategically organize, proactively lead, holistically controlled and dynamically implemented if best value is critical. The main research of which this paper forms part of intends to achieve this aim. That is the only way that the current practices would move towards systemic maintenance management systems.

Table 3: Frequency of effects of maintenance systems

Practice	Effect	Level of effect (%)					Mean	Average Mean
		1	2	3	4	5		
Reactive	Poor service delivery	15.2%	18.2%	33.3%	24.2%	9.1%	2.939	**2.94**
	Maintenance backlogs	12.1%	24.2%	18.2%	42.4%	3.0%	3.000	
	Poor user satisfaction	15.2%	21.2%	27.3%	33.3%	3.0%	2.879	
Routine	Poor service delivery	24.2%	63.6%	12.1%	0.0%	0.0%	1.879	**1.98**
	Maintenance backlogs	21.9%	56.3%	15.6%	6.3%	0.0%	2.063	
	Poor user satisfaction	21.2%	57.6%	12.1%	9.1%	0.0%	2.001	
Condition	Poor service delivery	24.2%	54.5%	15.2%	6.1%	0.0%	2.030	**2.10**
	Maintenance backlogs	27.3%	45.5%	15.2%	12.1%	0.0%	2.121	
	Poor user satisfaction	24.2%	51.5%	12.1%	12.1%	0.0%	2.121	

SUMMARY AND CONCLUSIONS

The paper has been able to outline the shortcomings with each of the maintenance practices. Thus identify the need for more detail research towards the development of systemic maintenance management philosophy that is based on the principle of value. The art and science of maintenance management is a rigorous process that strives to sustain a building's set of facilities by using minimum resources, while at the same time impacting little or no disruption be it to the users or others at the periphery. The value drives is the focus for more effective and efficient strategy of creating value to maintenance organization and building users. Building and it maintenance should be considered as factors of production.

ACKNOWLEDGEMENT

We sincerely acknowledge the comments and suggestions of anonymous commentators. The authors also gratefully acknowledge the assistance and supports received from the Universiti Teknologi PETRONAS.

REFERENCES

[1] Olanrewaju, A., Case for alternative approach to building maintenance management of public universities. *Journal of Building Appraisal*, (2010) Issue 5, pp201–212.

[2] Jones, K. and Sharp, M., A New Performance Based Process Model for Built Asset Maintenance. *Facilities*, (2007)Vol. 25 No. 13/14, pp525-535

[3] Reffat, R. M., Gero, J. S. and Peng, W.,Using data mining on building maintenance during the building life cycle, *In Proceedings of the 38th Australian and New Zealand Architectural Science Association (ANZASCA) Conference,* School of Architecture, University of Tasmania, Tasmania, Australia, (2004)pp.91-97

[4] Edwards, D.J, Holt, G. D and Harris, F.C., Predictive maintenance techniques and their relevance to construction plant. *Journal of Quality in Maintenance Engineering (JQME),* Vol. 4 No. 1, 1998, pp25 -37, MCB

[5] Newman, A.P.E., Structural renovation of building: methods, details, and design examples, McGraw Hill, New York. (2001)

[6] Wordsworth, P., *Lee's Building Maintenance Management,* 4th Edn. Oxford: Blackwell Science Limited (2001)

[7] Tsang, A. H. C., Strategic dimensions of maintenance management, Journal of Quality Maintenance Engineering, Vol. 8 No.1, 2002, pp-7-39,

[8] Muijs, D., Doing Quantitative Research in Education with SPSS, London: Sage Publications (2004)

Comparative Study Between High and Low Concentration of Natural Additives on Drag Reduction in Pipelines Carrying Water

Nithiya D/O Arumugam and Hayder A. Abdul Bari
Faculty of Chemical & Natural Resources Engineering,
University Malaysia Pahang, Lebuhraya Tun Razak, 26300 Kuantan, Pahang Darul Makmur
* Corresponding author: Phone: 012-2669120, email: nithiyagurl@yahoo.com

Abstract
Natural additive (drag reduction agent) was extracted from leaves of *Hibiscus rosa-sinensis* and experimentally tested in a closed loop liquid circulation system of turbulent water flow. Water used as the carrying liquid in pipelines which pumped from reservoir tank that readily mixed with prepared mucilage. Liquid pumped through pipe with internal diameter of 0.5" and testing length of 2m. Drag reduction efficiency for four different concentrations (50ppm, 200ppm, 600ppm and 800ppm) of mucilage as well as effect of Reynolds number were studied. The results show that, percentage drag reduction increases as concentration of polymer increases. Maximum drag reduction of 48% obtained for 800ppm of hibiscus mucilage (natural additives) for Reynolds number 107950 in water flowing system.

Keywords
Drag reduction; Natural additive; Concentration; Reynolds number

INTRODUCTION

After Tom's (1949) discovery on drag reduction using polymeric additives, it becomes as an active field of research over the years. This phenomenon become the subject of research and received more attentions. Detailed explanations on drag reduction phenomenon are given by Lumley (1969), De Gennes (1990) and Gyr (1995).

Den Toonder et al. (1997) and Den Toonder (1995) have been carried out experiments in a pipe flow with very low concentration of polymers which leading to a small amount of drag reduction. Detailed mechanism of drag reduction is not fully understood. The basic understanding is that this phenomenon is associated with the viscoelasticity of polymer solutions where both alignment and elongation of the polymer chains can play an important role (Torgeir, 2004). Two processes, the stretching of the chains by the velocity gradients and the relaxation due to the elasticity of the molecules, determine the deformation of polymer chains.

Nam (2009) too studied the effect of polymer (polyethylene oxide) concentrations on the drag reduction. He observed that maximum drag reduction rate of 50% at concentration of 20wppm. Sohn (2001) characterize xanthan gum as a drag reducer with approximately 50% of the maximum drag reduction obtained for rotating disk at 400ppm.

Present research use natural additive instead of synthetic due to the advantage of natural polymer in the high mechanical stability against degradation when compared to flexible synthetic polymers with similar molecular weights; however they are highly susceptible to biological degradation. Certain industrial polymers (Chakrabarti, 1991a; Chakrabarti, 1991b; and Deshmukh, 1987) such as hydroxypropylguar, guar gum and xanthan gum, have been found to be reasonably shear-stable DRA.

Mucilage of *Hibiscus rosasinensis* leaves (natural polymer) chose as a raw material to reduce frictional drag formed in turbulent flow by testing in closed loop liquid circulation system. The availability, properties and characterization of this natural polymer made it chose as drag reducing agent in this case. The effect of polymer concentrations as well as comparative study at high and low concentrations were studied.

METHODOLOGY

Experimental rig

The project is to be carried out by building a fluid circulation system (flow loop) with different pipe diameters. Components in the flow loop will include, among others ultrasonic flow rate measurement equipment, transmitter sensor to detect pressure at each section points and usual rheological testing methodologies for the apparent physical and chemical properties of the circulated liquids.

Basically, the experimental work initiate by pumping water from reservoir tank which mixed homogenously with mucilage of *Hibiscus rosa-sinensis* leaves. Solution pumped in certain flow rate for three different pipe diameters. Pipe of closed loop circulation system made of visible PVC and galvanized iron pipes. Appendix 1 shows the

schematic diagram of closed loop circulation system.

RESULTS AND DISCUSSIONS

Pressure Drop Analysis

Degree of turbulency before and after addition of mucilage presented in figure 1. Pressure drop for two different concentration as shown below indicate that for higher concentration, the pressure difference between 0ppm and 600ppm higher than that of 50ppm.

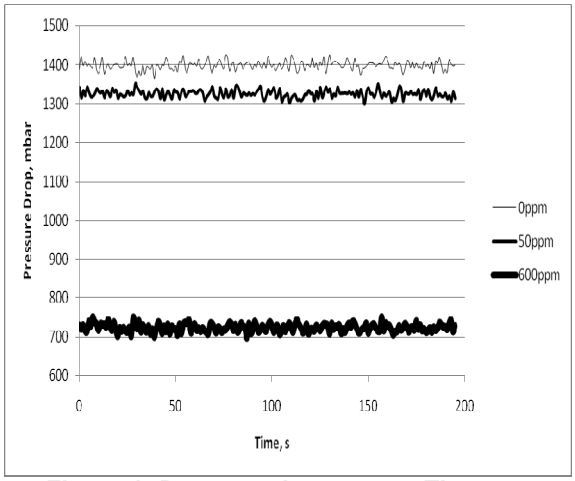


Figure 1: Pressure drop versus Time

Percent Drag Reduction versus concentration at different Reynold Numbers

Fig. 2 represents the dependence of DR (drag reduction) efficiency on polymer concentration at four different Reynolds number (Re). As seen, the DR efficiency of higher polymer concentration is larger than that of lower concentration for all the given Re. At 800ppm, a maximum percent DR value that is 48% achieved. Apparently, for all Re, the DR efficiency increases as polymer concentration. In contrast to this fact, for Re=99483.33 and Re=91016.67, the percent DR value started to decrease slightly after 400ppm. This may occur due to the mechanical degradation of the polymer molecules used as explained by Kim et al. (2000). Generally, mechanical degradation is caused by mechanical energy input to the polymers in solutions, which means passing the solution through pumps and pipes. Therefore, the activity of pumps does influence the efficiency of added polymer in pipelines. Pollert and Sellin (1989), Singh (1990), Moussa and Tiu (1994), Nguyen and Kausch (1986) and others too have investigated the phenomena of polymer's mechanical degradation extensively as part of their research scope.

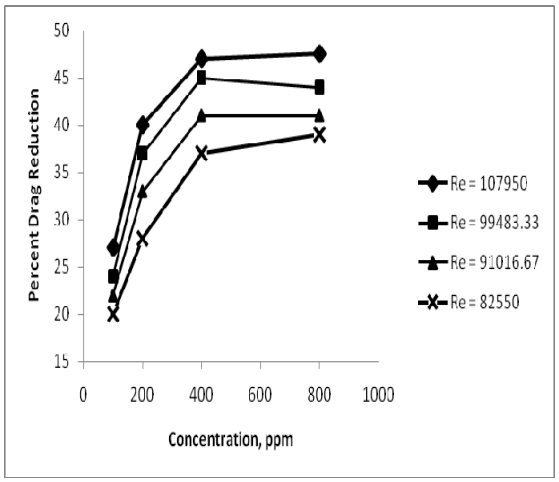


Figure 2: %DR Versus Concentration for 0.0381m pipe

%DR versus Reynolds Number for different concentrations

This section discusses on relationship between percent DR and Reynold numbers as summarized in Fig. 3. The visibility of DR percentage increases as Reynolds number increases for all the given concentrations. The Re measures dependent on flow rate of liquids pumped. At higher concentration, percent DR always results with higher value. Remarkably, at Re=99483.33and polymer concentration of 400ppm, the percent DR is extraordinarily higher than that of 800ppm. This situation may arise due to the liquid flow fluctuations in pipelines at turbulent flow. This is an exceptional case, as the performance of polymer at this state is not effective and irrelevant from the research results presented by other researchers.

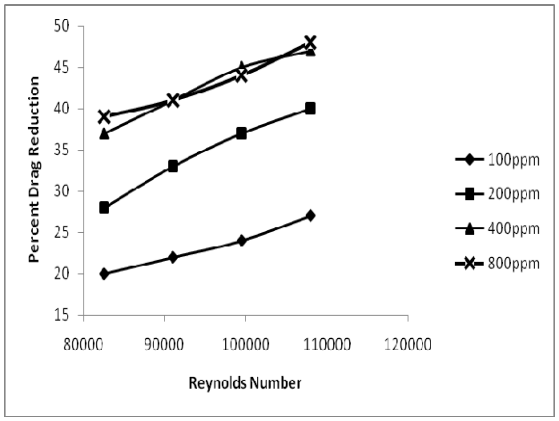


Figure 3: %DR Versus Reynolds Number for 0.0381m pipe

CONCLUSIONS

The drag reduction behavior of four different concentrations of natural additives is investigated. Drag reduction increases with polymer concentration until reaches a maximum drag reduction for given Re values. It's discovered that,

at 800ppm and Re=107950, maximum value of drag reduction 48% obtained experimentally. Drag reduction efficiency is intimately related to the parameters, such as concentration and Reynolds number. At certain point where the DR efficiency reduces although the additive concentrations increased uniformly. Mechanical degradation will be the answer for this situation due to pumps activity. Overall, these results show that the drag reduction effect tends to increase with increasing additive concentration and Re. Finally, mucilage of *Hibiscus rosa-sinensis* is confirmed to be a suitable drag reducing agent.

ACKNOWLEDGMENTS

This work was supported by Faculty of Chemical & Natural Resources Engineering, University Malaysia Pahang (2010). The authors wish to thank everyone for their helps in this study.

REFERENCES

[1] Toms, B. A., 1949. Observation on the flow of linear polymer solutions through straight tubes at large Reynold numbers. *In Proc. Intl Rheological Congress,* Holland, 135-141.

[2] Lumley, J. L., 1969. Drag reduction by additives. *Ann. Rev. Fluid Mech.,* 1: 367. doi:10.1146/annurev.fl.01.010169.002055

[3] De Gennes P. G., 1990. Introduction to polymer dynamics. *J. Fluid Mech.*doi:10.1063/1.2810290

[4] Gyr, A., and Bewersdorff, H. W., 1995. Drag Reduction of Turbulent Flows by Additives. *Kluwer Academic Publishers, Dordrecht*.

[5] Den Toonder, J. M. J., Hulsen, M. A., Kuiken, G. D. C. and Nieuwstadt, F. T. M., 1997. Drag reduction by polymer additives in a turbulent pipe flow:Laboratory and numerical experiments. *J. Fluid Mech.* 337: 193-231. doi:10.1017/S0022112097004850

[6] Den Toonder, J. M. J., 1995. Drag reduction by polymer additives in a turbulent pipe flow: Laboratory and numerical experiments. *Ph.D. Thesis, Delft University of Technology, Delft, The Netherlands*.

[7] Torgeir Nakken, Morten Tande and Bo Nystrom, 2004. Effects of molar mass, concentration and thermodynamic conditions on polymer-induced flow drag reduction, *European Polym. Journal* 40: 181-186. doi:10.1016/j.eurpolymj.2003.09.006

[8] Nam-Jin Kim, Sin Kim, Sang Hoon Lim, Kuan Chen and Wongee Chun, 2009. Measurement of drag reduction in polymer added turbulent flow. *Intl Communication in Heat and Mass Transfer*, 36: 1014-1019. doi:10.1016/j.icheatmasstransfer.2009.08.002

[9] Sohn, J. I., Kim, C. A., Choi, H. J., and Jhon, M. S., 2001. Drag-reduction effectiveness of xanthan gum in a rotating disk apparatus. *Carbohydrate Polym*., 45: 61-68. doi:10.1016/S0144-8617(00)00232-0

[10] Chakrabarti, S., Seidl, B., Vorwerk, J. and Brunn, P. O., (1991a). The rheology of hydroxy-propylguar (HPG) solutions and its influence on the flow through a porous medium and turbulent tube flow, respectively (Part 1). *Rheologica Acta, 30*: 114-123. doi:10.1007/BF01134600

[11] Chakrabarti, S., Seidl, B., Vorwerk , J. and Brunn, P. O., (1991b). Correlations between porous medium flow data and turbulent tube flow results for aqueous hydroxypropylguar solutions (Part 2). *Rheologica Acta, 30*:124-130. doi:10.1007/BF01134601

[12] Deshmukh, S. R. and Singh, R. P., 1987. Drag reduction effectiveness, shear stability and biodegradation resistance of guar gum-based graft copolymers. *Journal of Applied Polymer Science,* 33: 1963-1975. doi:10.1002/app.1987.070330610

[13] Kim, C. A., Kim, J. T., Lee, K., Choi, H. J. and Jhon, M. S., 2000. Mechanical degradation of dilute polymer solutions under turbulent flow. *Polymer* 41: 7611-7615. doi:10.1016/S0032-3861(00)00135-X

[14] Pollert, J. and Sellin, R. H. J., in Sellin, R. H. J. and Moses, R. T., eds., 1989. Drag Reduction in Fluid Flows*, Ellis Horwood, Chichester, U.K.,* 179-188.

[15] Singh, R. P., 1990. *Encyclopedia of Fluid Mechanics*, Vol. 9, Gulf Publishing Co., Houston, Tex., Chapt. 14: 425-480.

[16] Mousa, T. and Tiu, C., 1994. *Chem. Eng. Sci*. 49: 1681-1692.

[17] Nguyen, T. R. and Kausch, H. H., 1986. *Colloid Polym. Sci.,* 264; 764-772.

Implementation of Server Virtualization in Data Centers to Maximize the Efficiency and Reduce the Cost of Ownership

Mueen Uddin[1], Azizah Abdul Rahman[2]
[1] Department of Information Systems, Universiti Teknologi Malaysia
{Mueenmalik9516}@gmail.com, {azizahar}@utm.my

ABSTRACT
Data centers are the building blocks of IT business enterprises providing the capabilities of centralized repository for storage, management, networking and dissemination of data. With the rapid increase in the capacity and size of data centers, there is a continuous increase in the demand for energy consumption. These data centers not only consume a tremendous amount of energy but are riddled with IT inefficiencies. Data center are plagued with thousands of servers as major components. These servers consume huge energy without performing useful work. In an average server environment, 30% of the servers are "dead" only consuming energy, without being properly utilized. This paper proposes a five step model using an emerging technology called virtualization to achieve energy efficient data centers. This process helps to make data centers green and energy efficient so as to ensure that IT infrastructure contributes as little as possible to the emission of green house gases, and helps to regain power and cooling capacity, recapture resilience and dramatically reducing energy costs and total cost of ownership.

Keywords
Virtualization; Data centre; Green Technology; Carbon Footprints; live migration.

INTRODUCTION
Data centers are the building blocks of any IT business organization, providing capabilities of centralized storage, backups, management, networking and dissemination of data in which the mechanical, lighting, electrical and computing systems are designed for maximum energy efficiency and minimum environmental impact [1]. Data centers are found in nearly every sector of the economy, ranging from financial services, media, high-tech, universities, government institutions, and many others. They use and operate data centers to aid business processes, information management and communication functions [2]. Due to rapid growth in the size of the data centers there is a continuous increase in the demand for both the physical infrastructure and IT equipments, resulting in continuous increase in energy consumption.

Data center IT equipment consists of many individual devices like Storage devices, Servers, chillers, generators, cooling towers and many more. Servers are the main consumers of energy because they are in huge number and their size continuously increases with the increase in the size of data centers. This increased consumption of energy causes an increase in the production of green house gases which are hazardous for environmental health.

Virtualization technology is now becoming an important advancement in IT especially for business organizations and has become a top to bottom overhaul of the computing industry. Virtualization combines or divides the computing resources of a server based environment to provide different operating environments using different methodologies and techniques like hardware and software partitioning or aggregation, partial or complete machine simulation, emulation and time sharing [3].

It enables running two or more operating systems simultaneously on a single machine. Virtual machine monitor (VMM) or hypervisor is a software that provides platform to host multiple operating systems running concurrently and sharing different resources among each other to provide services to the end users depending on the service levels defined before the processes [4].

Virtualization and server consolidation techniques are proposed to increase the utilization of underutilized servers so as to decrease the energy consumption by data centers and hence reducing the carbon footprints [4].

This paper will explain some of the necessary requirements to be fulfilled before implementing virtualization in any firm.

Section 2 emphasizes the need for implementing virtualization technology in a data center and provides a five step process of implementing it. Section 3 discusses some of the advantages of virtualization after being implemented. In the end conclusions and recommendations are given.

PROBLEM STATEMENT
Data Centers are the main culprits of consuming huge energy and emitting huge amount of CO2, which is very hazardous for global warming. Virtualization technology provides the solution but it has many overheads, like single point of failure, total cost of ownership, energy and efficiency calculations and return of investment.

LITERATURE REVIEW

In recent years the commercial, organizational and political landscape has changed fundamentally for data centre operators due to a confluence of apparently incompatible demands and constraints.

The energy use and environmental impact of data centers has recently become a significant issue for both operators and policy makers. Global warming forecasts that rising temperatures, melting ice and population dislocations due to the accumulation of greenhouse gases in our atmosphere from use of carbon-based energy. Unfortunately, data centers represent a relatively easy target due to the very high density of energy consumption and ease of measurement in comparison to other, possibly more significant areas of IT energy use. Policy makers have identified IT and specifically data centre energy use as one of the fastest rising sectors. At the same time the commodity price of energy has risen faster than many expectations. This rapid rise in energy cost has substantially impacted the business models for many data centers. Energy security and availability is also becoming an issue for data centre operators as the combined pressures of fossil fuel availability, generation and distribution infrastructure capacity and environmental energy policy make prediction of energy availability and cost difficult [5].

As corporations look to become more energy efficient, they are examining their operations more closely. Data centers are found a major culprit in consuming a lot of energy in their overall operations. In order to handle the sheer magnitude of today's data, data centers have grown themselves significantly by continuous addition of thousands of servers. These servers are consuming much more power, and have become larger, denser, hotter, and significantly more costly to operate [6]. An EPA Report to Congress on Server and Data Center Energy Efficiency completed in 2007 estimates that data centers in USA consume 1.5 percent of the total USA electricity consumption for a cost of $4.5 billion [7]. From the year 2000 to 2006, data center electricity consumption has doubled in the USA and is currently on a pace to double again by 2011 to more than 100 billion kWh, equal to $7.4 billion in annual electricity costs [8].

Gartner group emphasizes on the rising cost of energy by pointing out that, there is a continuous increase in IT budget from 10% to over 50% in the next few years. Energy increase will be doubled in next two years in data centers [9]. The statistics Cleary shows that the yearly cost of power and cooling bill for servers in data centers are around $14billion and if this trend persists, it will rise to $50billion by the end of decade [10].

With the increase in infrastructure and IT equipment, there is a considerable increase in the energy consumption by the data centers, and this energy consumption is doubling after every five years. [11]. Today's data centers are big consumer of energy and are filled with high density, power hungry equipment. If data center managers remain unaware of these energy problems then the energy costs will be doubled between 2005 and 2011. If these costs continue to double every five years, then data center energy costs will increase to 1600 % between 2005 and 2025 [12]. Currently USA and Europe have largest data center power usage but Asia pacific region is rapidly catching up. [13].

PROPOSED WORK

Servers are the leading consumers of IT power in any data center. Data centers are plagued with thousands of the server's mostly underutilized, having utilization ratio of only 5 to 10%, consuming huge energy and generating huge amount of green house gases.

This paper focuses on the use of virtualization to overcome energy problems in data centers. In this paper we proposed a five step process to implement virtualization in a data center to save energy and at the same time increases the productivity of servers with little or no additional energy consumption.

Planning For Virtualization

Before implementing server virtualization in any firm it is important to seriously plan and consider virtualization risks associated with it. It is also important for the data center to check whether it has the necessary infrastructure to handle the increased power and cooling densities arise due to the implementation of virtualization.

It is also important to consider the failure of single consolidated server, because it is handling the workload of multiple applications. In order to properly implement virtualization there is a need to answer some of the questions:

- What is virtualization?
- Why we need it?
- How it can improve our businesses?
- Types of virtualization technologies exist?
- What is cost/benefit ratio of virtualization?
- What new challenges it will bring to the business firm?
- Structure of the virtualization solution being implemented?
- Which applications or services are good virtualization candidates?
- Which server platforms best suited to support virtualization?

Process of Virtualization

Like any other IT project, virtualization projects must also be structured and designed in such a way that they must fulfill the necessary requirements and should be within the infrastructure domain already installed. It is much more than simply loading a virtualization technology on a server and transforming one or two workloads into virtual machines.

Virtualization process involves five key steps to be followed while implementing virtualization. These steps are important because they provide a detailed description about the requirements to be fulfilled before implementation.

- Discovery
- Virtualization
- Hardware Maximization
- Architecture
- Management

Discovery

The process of virtualization starts by creating an inventory of all servers, resources they require, available resources and their associated workloads, this process is called discovery process. The inventory process includes both utilized and idle servers. It also includes information related to

- Make and Model of the Processor
- Types of processors (socket, Core, Threads, Cache)
- Memory size and speed
- Network type (Number of ports, speed of each port)
- Local storage (number of disk drives, capacity, RAID)
- Operating system and their patch levels (service levels)
- Applications installed
- Running services

The discovery process identifies and analyzes an organizations network before it is being virtualized. It consists of following phases:

Inventory

It is very important for an organization to know in advance the total content of its infrastructure before implementing virtualization. This is the most important step in any virtualization project. There are many tools available from different vendors for performing initial analysis of an organization.

Microsoft Baseline Security Analyzer (MBSA) tool provides different information like IP addressing, Operating System, installed applications and most importantly vulnerabilities of every scanned system. After analyzing, all generated values are linked to MS Visio, which generates a complete inventory diagram of all components and also provides details about each component being analyzed.

Microsoft Assessment and Planning toolkit (MAP) is another tool for the assessment of network resources. It works with windows management instrumentation (WMI), the remote registry service or with simple network management protocol to identify systems on network.

VMware, the founder of X-86 virtualization, also offers different tools for the assessment of servers that could be transformed into virtual machines.

VMware Guided Consolidation (VGC) a powerful tool assesses network with fewer than 100 physical servers. Since VGC is an agentless tool it doesn't add any overhead over production server's workload.

Categorize Server Resources

After creating server inventory information, the next step is to categorize the servers and their associated resources and workloads into resource pools. This process is performed to avoid any technical political, security, privacy and regulatory concern between servers, which prevent them from sharing resources. Once analysis is performed, we can categorize each server roles into groups. Server roles are categorized into following service types:

- Network infrastructure servers
- Identity Management servers
- Terminal servers
- File and print servers
- Application servers
- Dedicated web servers
- Collaboration servers
- Web servers
- Database servers

Categorizing Application Resources

After categorizing servers into different resource pools, applications will also be categorized as

- Commercial versus in-house
- Custom applications
- Legacy versus updated applications
- Infrastructure applications
- Support to business applications
- Line of business applications
- Mission critical applications

Allocation of Resources

After creating the workloads, the next process is to allocate computing resources required by these different workloads and then arranging them in normalized form, but for normalization the processor utilization should be at least 50%.

It is very important to normalize workloads so as to achieve maximum efficiency in terms of energy, cost and utilization.

The formula proposed in this paper for normalization is to multiply utilization ratio of each server by total processor capacity that is (maximum processor efficiency * number of processors * number of cores).

Virtualization

After analyzing and categorizing servers, second step defines virtualization in detail, its advantages, its types, layers and most importantly vendor identification whose product most suits and fulfills all criteria for data gathered in first step.

VMware Capacity Planner (VCP) tool can be used when network size extends over 100 physical servers. It generates reports on server processor utilization including CPU, Memory, and network and disk utilization on server by server basis and finally identifies potential virtualization candidates.

Other tools like CIRBA's Power Recon and Plate Spin's are also very useful tools which analyze technical and non-technical factors in data centers and generate reports for the consolidation of servers .

It should be noted that all these analysis should be run on time for a period of at least one month; this will generate high and low utilization ratios for each server.

Hardware Maximization

This is the most important step of virtualization process. Since servers are now going to run multiple virtual workloads, it is important to consider hardware issues because already available hardware is not enough and suitable for providing high availability of virtual workloads. A change is required to install new hardware that supports and delivers the best price and performance. This process ensures high availability of virtual workloads and also provides leaner and meaner resource pool of resources for these virtual workloads.

Move To 64-Bit Architecture

One of the major issues in hardware maximization is the proper utilization and availability of RAM for each virtual machine. For this reason it is important to consider 64 bit architecture, which provides more utilization and availability of RAM for all virtual and physical systems.

Rely On Shared Storage

It is also important to consider single point of failure because one server is now running the workloads of multiple servers. If this server goes down the whole process of virtualization becomes fail. To remove the chances of single point of failure at any stage can be achieved by using redundancy and clustering services to protect virtual workloads. These services are mostly provided by Microsoft and Citrix. While VMware on the other hand uses custom configuration approach called High availability (HA).

Architecture

The architecture of a machine consists of set of different instructions that allow inspecting or modifying machine state trapped when executed in any or most probably the privileged mode. To support proper hardware utilization, it is important to update and revise whole datacenter architecture. To protect virtual workloads, x-64 systems should be linked to shared storage and arranged into some form of high availability clusters so as to minimize the single point of failure.

Management of Virtualization

Virtualized data centers are managed by dividing the functionalities of data center into two layers.

1) Resource Pool (RP)
2) Virtual service offering (VSO)

It is important to note that conversion should always be preferred when servers are offline to protect existing services and maintain service level agreements (SLA) with end users.

BENEFITS OF VIRTUALIZATION

Virtualization promises to radically transform computing for the better utilization of resources available in the data center reducing overall costs and increasing agility. It reduces operational complexity, maintains flexibility in selecting software and hardware platforms and product vendors. It also increases agility in managing heterogeneous virtual environments. Some of the benefits of virtualization are

Server & Application Consolidation

Virtual machines can be used to consolidate the workloads of under-utilized servers on to fewer machines, perhaps a single machine. The benefits include savings on hardware and software, environmental costs, management, and administration of the server infrastructure.

The execution of legacy applications is well served by virtual machines. A legacy application may not run on newer hardware or operating systems. Even if it does, it may under-utilize the server, hence virtualization consolidates several such applications, which are usually not written to co-exist within a single execution environment. Virtual machines provide secure, isolated sandboxes for running entrusted applications. Examples include address obfuscation. Hence Virtualization is an important concept in building secure computing platforms.

Multiple Execution Environments

Virtual machines can be used to create operating systems or execution environments that guarantee resource management by using resource management schedulers with resource limitations. Virtual machines provide the illusion of hardware configuration such as SCSI devices. It can also be used to simulate networks of independent computers. It enables to run multiple operating systems simultaneously having different versions, or even different vendors.

Debugging and Performance

Virtual machines allow powerful debugging and performance monitoring tools that can be installed in the virtual machine monitor to debug operating systems without losing productivity. Virtual machines provide fault and error containment by isolating applications and services they run. They also provide behavior of these different faults. Virtual machines aid application and system mobility by making software's easier to migrate, thus large application suites can be treated as appliances by "packaging" and running each in a virtual machine.

Virtual machines are great tools for research and academic experiments. They provide isolation, and encapsulate the entire state of a running system. Since we can save the state, examine, modify and reload it. Hence it provides an abstraction of the workload being run.

Resource Sharing

Virtualization enables the existing operating systems to run on shared memory multiprocessors. Virtual machines can be used to create arbitrary test scenarios, and thus lead to very imaginative and effective quality assurance. Virtualization can also be used to retrofit new features in existing operating systems without "too much" work. Virtualization makes tasks such as system migration, backup, and recovery easier and more manageable. Virtualization provides an effective means of binary compatibility across all hardware and software platforms to enhance manageability among different components of virtualization process.

Physical To Virtual Live Migration

This is the most critical, time-consuming and painful operation when performed manually, since it includes cloning existing operating system and restoring it on an identical machine, but at the same time changing the whole underlying hardware, which can lead to driver reinstallation or possibly the dreadful blue screen of death.

To avoid these ambiguities, virtualization vendors started to offer different physical to virtual (P2V) migration utilities. This utility software speeds up the movement of operation and solves on the fly driver incompatibilities, by removing physical hardware dependencies from server operating systems and allowing them to be moved and recovered. Instead of having to perform scheduled hardware maintenance at some obscure hour over the weekend, server administrators can now live migrate a VM to another physical resource and perform physical server hardware maintenance in the middle of the business day.

Virtuozzo for Windows 3.5.1 SWsoft itself introduced a physical to virtual (P2V) migration tool called VZP2V. This tool can remotely install P2V knowing machine administrative username and password.

CONCLUSION

This paper highlights the importance of virtualization technology being implemented in data centers to save the cost and maximize the efficiency of different resources available. We proposed a five step model to properly implement virtualization. It starts by categorizing servers and their associated applications and resources into different resource pools.

It is important to consider that virtualization not only needs to characterize the workloads that are planned to be virtualized, but also target the environments into which the workloads are to be applied. It is important to determine the type of servers, their current status whether idle or busy, how much it will cost to implement server virtualization, the type of technology needed to achieve the service levels required and finally meet the security/privacy objectives. It is also important for the data center to check whether it has the necessary infrastructure to handle the increased power and cooling densities arise due to the implementation of virtualization.

It is also important to consider the failure of single consolidated server, because it is handling the workload of multiple applications. It poses many challenges to the data center physical infrastructure like dynamic high density, under-loading of power/cooling systems, and the need for real-time rack-level management. These challenges can be met by row-based cooling, scalable power and predictive management tools. These solutions are based on design principles that simultaneously resolve functional challenges and increase efficiency.

REFERENCES

[1] Data Center Journal (n.d.), "What is a data center", Data Center Journal, available at: http://datacenterjournal.com/index.php?option=com_content&task=view&id=63&Itemid= 147 (accessed March 16, 2009).

[2] T. Daim, J. Justice, M. Krampits, M. Letts, G. Subramanian, M. Thirumalai, "Data center metrics An energy efficiency model for

information technologu managers", Management of Environmental Quuality, Vol.20 No.6, 2009.
[3] Amit singh,, "An introduction to virtualization",http://www.kernelthread.com/publications/virtualization, 2004.
[4] Green Grid, "Using virtualization to improve data center efficiency", available at: www.thegreengrid.org/ (accessed February 2009).
[5] L. Newcombe, "Data centre energy efficiency metrics", 2009.
[6] W. McNamara, G. Seimetz, K. A. Vales, "Best Practices for Creating The Green Data Center", 2008.
[7] EPA Report to Congress on Server and Data Center Energy Efficiency – Public Law109-431, Environmental Protection Agency, Washington, DC, 2007.
[8] Tung, T. Data Center Energy Forecast, Silicon Valley Leadership Group, San Jose, CA, 2008.
[9] Gartner, "Cost Optimization and Beyond: Enabling Business Change and the Path to Growth", A Gartner Briefing, Gartner, London, 2009.
[10] EPA Report to Congress on Server and Data Center Energy Efficiency – Public Law109-431, Environmental Protection Agency, Washington, DC, 2009.
[11] Gartner, "Sustainable IT", A Gartner Briefing, Gartner, Dublin, 2008.
[12] Caldow, J. "The greening of Government: a study of how governments define the green agenda", p. 8, available at:www01.ibm.com/industries/government/ieg/pdf/green_gov_agenda.pdf, 2008.
[13] Kumar, R. Media Relations, Gartner, available at:www.gartner.com/it/page.jsp?id¼781012, 2008.

Reliable Video Geocasting over Vehicular Ad Hoc Networks

Kayhan Zrar Ghafoor[1], Kamalrulnizam Abu Bakar[2], C.-H. Ke and Alberto J. Gonzalez[3]
[1]Faculty of Computer Science & Information Systems, Universiti Teknologi Malaysia, 81310 UTM Skudai, Johor D. T Malaysia
[2]Department of Computer Science and Information Engineering, National Kinmen Institute of Technology, Kinmen, Taiwan
[3]Department of Telematic Engineering, Technical University of Catalonia/I2cat Foundation, Barcelona, Spain
Correspondence: mrkayhanz@gmail.com

ABSTRACT
Video communication over Vehicular Ad Hoc Networks (VANETs) has many applications, such as emergency video transmission, commercial advertisement and inter-vehicle digital entertainment. However, in urban vehicular scenario delivering video streams to high mobile vehicles is indeed a challenging task due to high radio interference, channel loss rate and burst packet losses. Thus, designing an error resilient scheme for reliable video geocasting in such harsh scenarios needs to be addressed. In this paper, we propose an error resilient scheme based on packet level Forward Error Correction (FEC) and interleaving technique for reliable video geocasting over VANET. The proposed scheme is able to adapt channel variations by using Real Time Control Protocol (RTCP) report of vehicles in the communication range of video source. To achieve a fair comparison with other error protection schemes, we have implemented a proposed error resilient scheme in Network Simulator 2 (NS 2). The results of simulation based study show that the proposed scheme is able to improve perceived video quality and protection efficiency while minimizing bandwidth overhead (introduced by proactive error recovery) in urban vehicular scenarios.

Keywords
VANET, video geocasting, packet level FEC, interleaving technique, quality of service

INTRODUCTION
Vehicular networks are an emerging field of technology, integrating ad hoc network and wireless LAN (WLAN) to achieve intelligent vehicle to vehicle communication. This intelligent inter vehicle communication fosters the deployment of innovative wireless communication applications based on real time streaming of video flows. Real time video communication between vehicles has several applications ranging from road safety, commercial advertisement and on road entertainment.

Vehicles can send an uninterrupted video file to nearby vehicles in the vicinity area. The reason of this capability, vehicles have embedded with large storage and ample of energy for video data computation and communication. Furthermore, the existing advancement of IEEE 802.11 standard supports video communication over vehicular networks [1].

However, mobility of vehicles leads to high variability of inter-vehicle communication channels based on IEEE 802.11 standard. This makes the real time video communication a very challenging task. On the other hand, the communication channel between vehicles is prone to radio frequency interference together with different forms of fading including multi-path and slow fading. As a consequence, the channel suffers both from high bit error rate and high packet error rate which leads to high packet loss. There are several reasons of packet loss such as channel error, congestion and packet delay, though this paper concentrate on packet loss produced from channel error.

In vehicular networks, random and burst errors frequently occur. One bit errors occur during transmission, the error may extend over several packets due to dependency among the frames of the compressed video file. These lengthy bursts of errors are now accepted [2-4] as being more severe to perceived video quality than randomly distributed errors. Thus, to overcome bit error rate, loss recovery of video streams is need to be addressed.

FEC can be applied to different symbols with in a packet (bit, byte, a block of bytes). In addition to that, FEC can be used in different Open System Inter-connected (OSI) layers such as application, network, Physical and MAC layer. In this paper, FEC is applied to complete packets in application layer, which is known as packet level FEC [6]. This technique is able to recover packet losses without retransmission request (retransmission of lost packets in large scale video transmission is often not practical) [5].

Packet level FEC is a mechanism of protecting RTP payloads against packet errors by adding a specified

FEC redundant data to the transport stream. Furthermore, the packet level FEC is combined with the interleaving technique to increase the error protection efficiency. This is because the combined schemes can scramble correlated burst packet losses and recover them. However, interleaving requires additional delay when interleaving depth (m) and block size (n) is too large. Thus, it is necessary to adaptively monitoring the packet loss pattern of wireless channel, in order to apply an effective interleaved FEC protection.

In VANET, the position and distance between vehicles are variable. In this case, the packet error rate and loss pattern also are variable between source and destinations. Actually, approaches like [7, 8] use interleaved FEC to protect wireless channel against burst packet loss. However, these approaches are error resilient to static wireless networks, position variation of wireless nodes were not taken into consideration. Still, most of the works focusing on static wireless or low mobility wireless networks. Therefore, an error resilient scheme is needed to be addressed for reliable video geocasting in urban vehicular traffic condition.

In this paper, we propose a scheme based on packet level interleaving FEC for reliable video geocasting over VANET. The proposed error resilient scheme is able to tackle the above mentioned issues. The first phase of this process generally consists of the system architecture of proposed error resilient scheme. The aim of this architecture is to demonstrate the functions of the proposed scheme. The second phase consists of demonstrating real time video streaming and RTP/RTCP protocols. This RTCP report provide accurate feedback that indicates for each transmitted packet per frame, whether it was loss or received. In the third phase, we adaptively vary the amount of redundancy according to the wireless channel condition. This adaptive variation is based on RTCP report of farthest vehicle. The fourth phase is based on the validating of proposed scheme based on simulations (NS 2), showing consistent gain in PSNR as well as maximizing the protection efficiency in urban vehicular scenario.

The reminder of this paper is organized as follows. Section 2 of this paper describes the related literatures. This is followed with a discussion on the detail of proposed error resilient scheme architecture and algorithm in section 3. A simulation setup and performance evaluations are highlighted in section 4. Finally, this paper ends with a conclusion of the study in section 5.

Related works and contributions of this work

Video Transmission over VANET

There has been a few amount of prior work in inter-vehicle video communication. The authors [9] have investigated architecture for video streaming over VANET whereas no real video data are used in their simulation, and only the delay is reported in the experimental test bed study. Some authors [10] have discussed two routing protocols: Source Based Forwarding (SBF) and Receiver Based Forwarding (RBF). The real video data are used to simulate video streaming over VANET. The authors also have used different traffic conditions for data forwarding to evaluate video streaming between platoons of vehicles.

In addition, the challenge of video streaming over VANET can be interpreted by the high channel errors of the vehicles in urban traffic conditions. The high packet loss and limited communication range of the vehicles incur frequent link disconnection and uneven network partition. Authors in [12] have combined data mulling technique with three strategies, network coding [11], erasure coding, and repetition coding. Specially, vehicles in the opposite direction are exploited as data mules to relay multimedia data to other vehicles to overcome intermittent connectivity in sparse vehicular ad hoc network. However, the analysis of the delay for relaying multimedia data is based on the theoretical mathematical model. The authors in [13] have investigated the emergency warning video dissemination to a platoon of vehicles following an accident area. The network coding algorithm was applied for the emergency video dissemination. The performance evaluation reveals the fact that network coding is reliable for video dissemination over VANET especially in high channel loss conditions. Moreover, the authors in [13] analytically have shown that network coding reduces delay in delivery across platoons via data mulling. However, the approaches discussed in above literatures just considered video communication; they all ignored the impact of position variations of vehicles on perceived video quality. In addition to that, they did not consider the error resilient scheme to improve the perceived video quality in high channel loss condition of vehicular network scenario.

Video Transmission over Wireless Networks

Recent years, error resilient mechanisms based on Automatic Retransmission Request (ARQ) and FEC are widely used to correct video stream errors [6,14]. The extensive studies in wireless multimedia communications have shown that the effect of FEC scheme on packet errors yields better bandwidth utilization and lower delay than ARQ. Thus, FEC schemes are increasing error resilient in wireless multimedia communications [7]. The most popular FEC scheme is Reed-Solomon (RS) codes to generate packet level FEC blocks. A FEC coder is a block coder that takes a block of **k** source packets as input and produces **n** FEC packets as output $(n > k)$. In the receiver, the original video data can be regenerated, if the number of packet errors is less than

decoding threshold for the FEC code. On the other hand, interleaving techniques are used to convert burst losses to equivalent numbers of isolated packet losses. In this way, it can be used to increase FEC efficient recovery.

However, the efficiency of FEC recovery depends upon both the size of FEC blocks and number of source packets that are interleaved and scrambled. Admittedly, it is necessary to estimate the channel dynamicity through the network level metrics (packet loss rate) to change the amount of FEC redundancy and interleaving depth. In [15], authors proposed an adaptive FEC mechanism for minimizing end to end video distortion. In this mechanism, the decision of packet transmission is based on bandwidth rate constraint. In [16], authors studied an error control adaptive mechanism based on the packet traces of Wireless LAN. In [17], authors proposed efficient packet-level interleaving with RS coding. Furthermore, literatures also suggest an algorithm based on delay-aware for minimizing delay generated due to interleaving. They have also shown that packet-level interleaving with FEC results in better video quality.

Some literatures also introduce the RTCP adaptive feedback which is used to optimize the amount of FEC redundancy. However, none of them look into the amount of packet loss variation which is carried by RTCP feedback with different position of wireless nodes. In vehicular networks, the mobile nodes represent vehicles that are travelling in a higher range of speed. Hence, the network topology changes very fast. This mobility causes on one hand, different distances between source and destinations (in the geocast region), on the other hand different speed of destinations. In both cases the packet loss pattern among different receivers are different with respect to the source, thus the feedback RTCP from different receivers have different packet loss. Thus, this distance variation leads to different packet loss pattern, hence different perceived video quality of receivers.

Geocasting over VANET

Inter-vehicle position based communication has been found to be more suitable for VANET environment. In this case, the physical positions of vehicles are required, in order to facilitate communication in high speed vehicular scenarios [20]. Thus, cars are assumed to be Global Positioning System (GPS) - enabled to know their geographic position. In addition to that, each vehicle periodically broadcasts a beacon to obtain the information of neighbour nodes. This information enables the geocast services over VANET. Geocasting is basically a location based multicasting [18]. The objective of geocasting is to deliver information to a group in a specified geographic area.

The basic access method IEEE 802.11 is based on Distributed Coordination Function (DCF). A node is initiating the transmission after the sensed channel is idle. This mechanism is based on CSMA/CA protocol to schedule the medium accessing. Although DCF is simple and efficient, it cannot support Quality of Service (QoS) for multimedia applications. It is for this reason, 802.11e [19] is developed for better access mechanisms and supports QoS. The IEEE 802.11e Enhanced Distributed Channel Access (EDCA) is designed to enhance the 802.11 DCF by providing the required QoS mechanisms [21]. In EDCA (as in DCF) the multicast traffic is defined as an unreliable service, i.e., it does not include the use of Acknowledgement (ACK) frames.

Contributions of this work

In this paper, we proposed an error resilient scheme based on packet level FEC and packet interleaving technique for reliable video geocasting over VANET. The proposed scheme has used RTCP feedback to optimize FEC redundancy and packet interleaving level as a function of channel variations in a vehicular traffic condition. The source vehicle selects (in the geocast region) the RTCP report of the farthest receiver vehicle. This is because longer distance yields higher packet loss, hence lower perceived video quality, thus selecting RTCP of farthest node could recover largest amount of packet loss of the nodes in geocast region. Therefore, we achieved the improvement of video quality and protection efficiency with respecting transmission constraints.

CONCLUSIONS

In this paper, we have proposed an error resilient scheme based on adaptive interleaved FEC RS(n,k) for reliable video geocasting over VANET. In this scheme, the source vehicle can adapt with the channel condition based on RTCP feedback. The source can dynamically change the amount of FEC with different distances of receivers in the geocast area. Moreover, the source takes into account the RTCP feedback of farthest node (highest packet loss) or aggregated the RTCP feedback of all the receivers. NS-2 extensive simulations were successfully carried out for significant gains in terms of average video quality and packet recovery. The video transmission without FEC or with fixed amount of FEC has been compared to the proposed error resilient mechanism and the proposed scheme gives better performance.

ACKNOWLEDGEMENT

The authors would like to thank to the administration of FSKSM and UTM for generous support. The authors also would like to thank Dr. Jörg Widmer for his invaluable help.

REFERENCES

[1] Singh JP, Bambos N, Srinivasan B, Clawin D. Wireless LAN performance under Varied Stress

Conditions in Vehicular Traffic Scenarios. *IEEE International Vehicular Technology Conference*; vol. 2, 2002, 743-747.

[2] Qu Q, Pei Y, Modestino JW , Tian X. Source adaptation-based wireless video transport: a cross-layer approach. *EURASIP Journal on Applied Signal Processing* 2006; 2006, 1-14.

[3] Liang YJ, Apostolopoulos JG, Girod B. Analysis of packet loss for compressed video: does burst-length matter? *IEEE International Conference on Acoustics, Speech and Signal Processing*; vol. 5, Hong Kong, China, 2003,684-687.

[4] Lee CW, Yang CS, Su YC. Adaptive UEP and packet size assignment for scalable video transmission over burst error channels. *EURASIP Journal on Applied Signal Processing* 2006; **2006**:1-9.

[5] Park K. QoS-sensitive transport of real-time MPEG video using adaptive forward error correction. IEEE International Conference on Multimedia Computing and Systems, pp. 426-432, June 1999.

[6] Nafaa A, Taleb T, Murphy L. Forward error correction strategies for media streaming over wireless networks. *IEEE Communications Magazine* 2008; **46(1)**, 72–79.

[7] Nafaa A, Mehaoua A. Joint loss pattern characterization and unequal interleaved FEC protection for robust H.264 video distribution over wireless LAN. *ELSEVIER Journal on Computer Networks* 2005; **49**,766–786.

[8] Nikaein N, Labiod H, Bonnet C. MA-FEC: A QoS-based adaptive FEC for multicast communication in wireless networks. *IEEE International Conference on Communications*, New Orleans, USA, June 2000, 954–958.

[9] Gao M, Ammar M.H, Zegura E.W. V3: a Vehicle-to-Vehicle Live Video Streaming Architecture. IEEE *International Conference on Pervasive Computing and Communications*, Kauai, HI, Mar 2005. 404-424.

[10] Xie F, Hua K. A, Wang W, and Ho Y. H. Performance study of live video streaming over highway vehicular Ad hoc networks. *International IEEE Vehicular Technology Conference,* USA, 2007, 2121-2125.

[11] Ahlswede R, Cai N, Li SYR., Yeung RW. Network information flow. IEEE Transaction on Information Theory 2000; **46(4),** 1204–1216.

[12] Park J, Lee U, Oh S, Gerla M. Delay analysis of car-to-car reliable data delivery strategies based on data mulling with network coding. *IEICE Transaction on Information and Systems* 2008; **E91–D (10)**, 2524-2527.

[13] Joon Sang P, Uichin L, Soon Y O, Mario G, Desmond S. L. Emergency related video streaming in VANET using network coding. *ACM International Workshop on Vehicular Ad Hoc Networks*, USA, 2006. 102-103.

[14] Long L, Ekram H. An analytical model for ARQ cooperative diversity in multi-hop wireless networks. IEEE Transactions on Wireless Communications 2008; **7 (2),** 1786-1791.

[15] Chakareski J, Chou PA. Application layer error-correction coding for rate-distortion optimized streaming to wireless clients. *IEEE Transactions on Communications* 2004; **52 (10)**, 1675-1687.

[16] David Eckhardt A, Steenkiste P. Trace-based evaluation of adaptive error correction for a wireless local area network. *Mobile Networks and Applications* 1999; **4(4),** 273-287.

[17] Rouzbeh R, Fleury M, Mohammed G. Adaptive Packet-Level Interleaved FEC for Wireless Priority-Encoded Video Streaming. *EURASIP Journal on Advances in Multimedia* 2009; **2009**, 1-14.

[18] Wang Y, Li F. Vehicular Ad Hoc Networks. Springer: London, 2009;1-23

[19] IEEE 802 Committee of the IEEE Computer Society, ANSI/IEEE Std 802.11e, "Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Medium Access Control (MAC) Quality of Service (QoS) Enhancements", Nov. 2005.

[20] Kayhan Z. G., Kamalrulnizam Abu Bakar. Inter-Vehicle Communication protocols for multimedia transmission. *IAENG International Conference on Communication Systems and Applications*. Hong Kong, China, March 2010, in press.

[21] Lin CH, Shieh CK, Ke CH, Chilamkurti N.K., Zeadally S. An adaptive cross-layer mapping algorithm for MPEG-4 video transmission over IEEE 802.11e WLAN. Springer Journal on Telecommunication Systems 2009; **42(3-4),** 223-234.

[22] Schulzrinne H, Casner S, Frederick R, Jacobson V. RTP: A Transport Protocol for Real-Time Applications. RFC 3550(Standard), Jul.2003.

[23] Chesterfield J, Schooler E, Ott J. RTCP extensions for single-source multicast sessions with unicast feedback. IETF Draft, version 4, September 2004.

[24] Wiethölter S, Hoene C, Design and Verification of an IEEE 802.11e EDCF Simulation Model in ns-2.26. TKN-03-19 Technical Report Series, November 2003.

[25] NS simulator, http://nsnam.isi.edu/nsnam/index.php/Main_Page, accessed: 25 January 2010.

[26] Evalvid, http://www.tkn.tu-berlin.de/research/evalvid/, accessed: 25 January 2010.

[27] YUV video sequences (CIF), http://www.tkn.tu-berlin.de/research/evalvid/cif.html, accessed: 25 January 2010.

SUMO Mobility Model, http://sumo.sourceforge.net/, accessed: 25 January 2010.

Evaluation Existing Capacity of Weaving Section

Shoraka. M[1], Othman C.P[2]
[1,2] University Technology Malaysia
*Shorakamoh@gmail.com

Abstract
Nowadays there have been numerous studies at freeway weaving sections. The purpose of this research present of previous researches about estimates of the capacity freeway weaving section. Previous researches on weaving areas have focused on many factors that impact the capacity of freeway weaving section, which were found to include the length of the weaving section, the weaving ratio, the percentage of heavy vehicles in traffic stream, driver characteristics, lane widths, lateral obstructions, speed limit differential between freeway and on-ramp and off-ramp, geometric configuration, number of lanes in weaving section and even percentage of contribution of the four traffic movements. The paper wants to compare among these factors and will mention which one of them most influence has in weaving section and closed the reality. Finally the results of study are compared to HCM 2000 and even it presents shortcoming and overestimate of HCM.

Key Words
Freeway weaving section, capacity, on-ramp, off-ramp.

INTRODUCTION

Traffics are important in urban area. They are involving of three basic variables volume or flow rate, speed, and density can be used to describe traffic in urban area. This research will model and analysis part of traffic interchanges that it is involving Capacity Analysis of on-Ramp & off-Ramp of an Interchange in Urban Area .In the 2000 Highway Capacity Manual, weaving is defined as the crossing of two or more traffic streams traveling in the same general direction along a significant length of highway without the aid of traffic control devices (with the exception of guide signs). Weaving sections are formed when a merge area is closely followed by a diverge area, or when a one-lane on-ramp is closed followed by a one-lane off-ramp and the two are joined by an auxiliary lane [5]. Weaving areas have long been studied by many researchers, however, only a few studies have directly addressed the estimation of weaving capacity. The procedures of the HCM (HCM 1950 and HCM 1965) for weaving area analysis were developed from data collected by a variety of agencies to estimate speeds at weaving areas [3]. In the 1985 edition of the HCM, improvements from the previous edition were in the estimation method for speeds of vehicles in the weaving areas and the classification of weaving area configurations [4]. In the HCM 1997 edition, the methodology used to analyze the operational performance of weaving areas was still based on the research conducted during the 1970s and 1980s, the only change from the previous edition was that the speeds of weaving and non-weaving vehicles were used to estimate density within the weaving area. The HCM 1997 still did not provide procedures for estimating the capacity of weaving segments. The HCM 2000 edit for the first time provides capacity estimates for weaving areas. Capacity estimates are based on the assumption that the boundary between congested and uncongested regimes of traffic flow is 27 pc/km/ln for freeway. There is no specific reason presented why these values are appropriate for capacity estimations. The HCM 2000 weaving methodology provides the classification type of weaving areas based on number of lane changing required by each weaving traffic stream as shown in table 1:

Table 1. Configuration Type Based on the HCM 2000 [5]

Number of Lane - changing	Number of Lane- changing Required by Movement Vw2		
Required by Movement Vw1	0	1	≥ 2
0	Type B	Type B	Type C
1	Type B	Type A	N/A
≥ 2	Type C	N/A	N/A

The result of this lane-changing activity is often significant turbulence within the weaving section itself. Thus, weaving areas often represent bottleneck locations. Also within weaving section, the maximum number of vehicles that can traverse them is highly dependent upon the contributions from the non-weaving and weaving traffic streams.Also capacity is maximum flow of vehicles that can logically be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway traffic and control conditions.
Weaving sections form areas of concentrated turbulence on freeways. Even though there are no fixed interruptions that disrupt the traffic stream (e.g., traffic signals), due to the intense lane changing maneuvers happening in weaving sections, traffic in a

weaving section is subject to turbulence in excess of that normally presents on basic freeway section. The turbulence causes special operational problems and design requirements and its impact must be considered. Although the existing state-of-the-art analysis and design of weaving sections provide some basic information regarding the relation between geometric features of weaving and some traffic characteristics, some basic questions about the mechanism of weaving are yet to be explored. For example, one might be interested in: the level of traffic at which weaving movement between lanes become hazardous, the effect of various lengths of weaving sections on traffic flow; or the impact of upstream condition on operational condition within weaving sections. Also today there are shortcoming in application of real analysis and evaluation of traffic problems. This problems address capacity in weaving section, high level of traffic turbulence in vicinity of ramps and in general reduction of weaving speed.

Factors Influencing Weaving Capacity

Capacity is typically expressed as the maximum rate of vehicles that can be reasonably expected to traverse a roadway facility. In this context, freeway weaving section capacity is a function of numerous factors. Included here are such factors as number of lanes in the weaving section, length of weaving section, proportion of heavy vehicles in the traffic stream, driver characteristics, lane widths, length of deceleration and acceleration lane, speed differential between freeway and ramp traffic, lateral obstructions, geometric configuration of a weaving section describes alignment of the merge and diverge gores and even weaving ratio (Fig. 1). More specifically, geometric configuration dictates lane-changing maneuvers that must be executed by weaving vehicles. It is generally assumed that a geometric configuration that promotes reduced lane-changing activity will provide more capacity than a configuration requiring a high rate of lane changing [1,2].

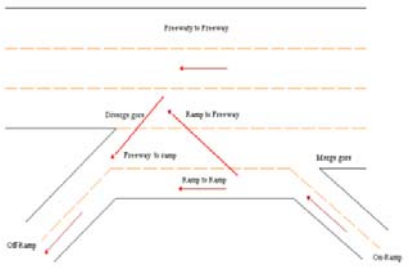


Figure 1. Weaving Area Traffic Movement

LITERATURE REVIEW

Research on weaving sections is not new; in fact it began more than half a century ago. Specifically, the HCM procedures can be traced back to the 1940s with the development of the 1950 Highway Capacity Manual, which included one of the first methods for analysis and design of weaving sections. The typical procedures for analysis of weaving sections can be categorized into two groups. One group of procedures estimate the performance of a weaving section and the other group of procedures estimate the capacity of a weaving section. The performance may be measured in terms of the level of turbulence, traffic stream speed, traffic stream density, and/or level of service. Alternatively, the weaving section can be characterized in terms of its throughput capacity. Most of the state-of-practice procedures focus on evaluating a weaving section in terms of its performance. The 1950 Highway Capacity Manual [3] presented one of the first methods for analyzing the operations and design of freeway weaving sections. It was based on the field data collected at six weaving sites in Washington D.C. and Arlington, Virginia, area in 1947. This method predicted both capacity and operating speeds. In 1985 HCM, complete definitions and descriptions of type A, B, and C weaving configurations were presented in terms of the number of lane changes that has to be made for successful completion of each weaving maneuver. weaving capacity was established as 1,800 pcph for type A configuration, and 3,000 pcph for types B and C. 1985 HCM also set the maximum length of weaving sections of 2,000 ft for Type A, and 2,500 ft for type B and C. It was suggested that beyond these lengths, operations should be considered as isolated merging and diverging actions rather that weaving. Cassidy and May [1] and Wang et al. [2] analyzed large amounts of empirical and simulation data collected from a number of sites throughout California and evaluated the capacity of freeway weaving sections. They found that the highest concentration of lane-changing activity occurred around the merge gore. The majority of lane changes occurred in the first 500 ft of the weaving area. The weaving flow rate (the sum of the two weaving flows) was the most significant factor affecting this longitudinal distribution along the weaving area. The capacity of a weaving section in this research was defined as the maximum flow of vehicles that could travel at any point in a single lane. Vermijs [14] developed a microscopic simulation approach for estimating weaving section capacities that evaluate capacity for several type A major weaves and ramp weaves. Three basic factors, which have impacts on weaving area, (1) weaving section length, (2) weaving flow, (3) the vehicle composition. The results showed that the capacity of the weaving section increased with the increasing of the length, up to a certain length. The length range from 400 to 1000 meters (1310 to 3280 feet) had no significant impact on weaving capacity. In addition, capacity decreases when the weaving flow increases. The 2000 HCM [5] provides lookup tables (Exhibit 24-8) that provide estimates of weaving section capacities as a function of a number of variables, namely: the weaving section

type (A,B and C),number of lanes, free-flow speed of freeway, length of weaving section, and volume ratio. The data bases used to calibrate the weaving procedures in HCM 2000 are very limited in size and quite outdated. Subsequent research has shown that the procedures' ability to predict the operation of the facility is limited. Another disadvantage of the 2000 HCM procedures is that the application range is quite limited. For example, for type A weaving sections with three lanes in the weaving area, the maximum volume ratio (VR) value that can be analyzed by this procedure is 0.45. But from simulation, operations with VR values greater than 0.45 is quite possible. Other concerns about the HCM 2000 procedures include lack of consistency in application with other freeway methods, the difficulty of determining the service measure in the field, and the difficulty in comparing the analysis results with the results of simulation models. Kwon et al. [7] developed an on-line procedure for estimating weaving section capacities. The study concluded that under free-flow conditions, the most significant factor affecting the speed of diverging vehicles is the geometric conditions of the exit ramp. Second, as the weaving volume increases, diverge vehicles tend to make lane changes earlier within the weaving section, while the ramp-to-freeway vehicles tend to travel a short portion on the auxiliary lane before merging into the mainline. Third, vehicles tend to use a limited portion of the auxiliary lane and that the length of the auxiliary lane utilization increases with increased weaving flows. Lertworawanich and Elefteriadou [8,9,10] proposed a methodology to estimate the capacities of Type B weaving areas based on gap acceptance and linear optimization. In order to use this methodology, firstly, traffic related parameters, traffic demand, and speeds of traffic on each lane should be collected. Secondly, maximum possible lane changes are calculated by using probability functions. Finally, the linear optimization problem is solved to get the capacity on the rightmost three lanes at the core weaving area. Hesham Rakha et al. [12] presents a very simple analytical model for estimating the capacity of weaving sections. The model includes three independent input variables: the weaving section length, the weaving section volume ratio, and weaving ratio $[\mathrm{WR} = v_{\mathrm{FR}}/(v_{\mathrm{FR}} + v_{\mathrm{RF}})]$.

The procedures developed in this study define a number of critical issues. First, the capacity of a weaving section reverts to the bottleneck capacity if the weaving volume ratio is set to zero irrespective of the length of the weaving section. Second, the weaving section capacity reverts to a merge section capacity when WR is zero. Similarly, the weaving section capacity reverts to a diverge section capacity when WR is 1.0. The paper demonstrates that the proposed model capacity estimates are consistent with field data. Furthermore, the study demonstrates that the HCM 2000 procedures tend to overestimate weaving section capacities significantly (errors in excess of 100% in some instances). Roess and Ulerio [13] wanted to remove the issue of configuration from the weaving analysis process. The new model was proposed in this paper, as a part of NCHRP Project 3-75, in order to calculate capacity of weaving area based on total lane-changing activities and speeds within the weaving section. It was modified from the equation used for estimating capacity of basic freeway segment by an additional factor, fwv, which reflects the impact of weaving vehicles.

EVALUATION OF EXISTING METHOD

Rakha , H [12] demonstrates that the HCM capacity estimates are only sensitive to the weaving section length when the volume ratio is less than 0.4, which is not the case with the proposed model, where the weaving section length affects the capacity for the full range of volume ratios. The paper demonstrates that the proposed model capacity estimates are consistent with field data. Furthermore, the study demonstrates that the HCM 2000 procedures tend to overestimate weaving section capacities significantly (errors in excess of 100% in some instances). The most factors influencing on weaving section capacity are including length of weaving section, geometric configuration (type of A,B and C- number of lane-changing), length of acceleration/ deceleration lane and number of lane in core weaving section.

CONCLUSION

This paper presented a proposed approach for evaluating the capacity of freeway weaving section, that the major finding of this research are as follows:

- The highest concentration of flow and the highest rate of lane changing in a weaving section occur near the merge gore, also weaving capacity was defined as a function of vehicle activity within the first 75 m of the weaving section in the two lanes adjacent to the merge gore. Functional value of capacity has been identified as the sum of all vehicles occupying all or any portion of a lane segment within critical region. This functional value of weaving capacity was found to be 5,900 pcph.
- The 2000 HCM [5] provides lookup tables (Exhibit 24-8) that provide estimates of weaving section capacities as a function of a number of variables, namely: the weaving section type (A,B and C),number of lanes, free-flow speed of freeway, length of weaving section, and volume ratio. The studies demonstrates that the HCM 2000 procedures tend to overestimate weaving section capacities significantly (even excess of 100% in some instances).
- In terms of practical design guidelines, the travel time reliability criterion on the freeway sections investigated here would require that the length of deceleration lanes should be longer than 200m, the length of acceleration lane should be longer

than 250m and the weaving length should be longer than 750m[6].

Also there are many factors Influencing Weaving Capacity therefore it needs to evaluating weaving section capacity by simulation model that it considers many aspects. Such results suggest the need for further exploration of evaluating of capacity weaving section for Malaysian roads to assess the applicability of the HCM method for capacity analysis for Malaysian conditions.

ACKNOWLEDGE

This paper presented here was part of results of investigate in University Technology Malaysia.

REFERENCES

[1] Cassidy.M, Skabardonis.A, May.A.D., *Operation of Major Freeway Weaving Sections: Recent Empirical Evidence*, Transportation Research Record 1225, Transportation Research Board, 1991.

[2] Cassidy, M.J., Wang, M.H., Chan, P., May, A.D.,. Evaluating the capacity of freeway weaving sections. Journal of Transportation Engineering 119, 360–384, 1993.

[3] *Highway Capacity Manual*, Highway Research Board, 1950.

[4] *Highway Capacity Manual*, Special Report 209, Highway Research Board, 1985.

[5] *Highway Capacity Manual*, Transportation Research Board, 2000.

[6] Huizhao, T., Hans, V.L., Henk., V.Z., Travel Time Variability versus Freeway Characteristics, IEEE Intelligent Transportation system conference, Toronto, Canada, 2006,p383-388.

[7] Kwon, E., Lau, R., and Aswegan, J., *Maximum Possible Weaving Volume for Effective Operations of Ramp-Weave Areas*, Transportation Research Record, n 1727, 2000, pp. 132-141.

[8] Lertworawanich.P, Elefteriadou.L, *Capacity Estimations for Type B Weaving Areas Using Gap Acceptance*, Transportation Research Record 1776, National Academy Press, 2001, pp. 24-34.

[9] Lertworawanich,P, Elefteriadou.L, *A methodology for estimating capacity at ramp weaves based on gap acceptance and linear optimization*, Transportation Research 37B, 2003, pp. 459-483.

[10] Lertworawanich.P, (Doctoral Dissertation), Capacity Estimation for Weaving Area Based on Gap Acceptance and Linear Optimization, University Pennsylvania (2003).

[11] Othman C.P,(Doctoral Dissertation), A Simulation Study of Speed And Capacity of Rural Single Carriageway Roads, University of Wales College of Cardiff(1999)UK.

[12] Rakha H. and Zhang Y. Analytical Procedures for Estimating Capacity of Freeway Weaving, Merge, and Diverge Section, Journal of Transportation Engineering, August 2006, pp. 618-628.

[13] Roess, R. P. and Ulerio, J. M., Weaving Area Analysis in Year 2000 Highway Capacity Manual, Transportation Research Record, n 1710 2000,pp 145-153.

[14] Vermijs.R, *New Dutch Capacity Standards for Freeway Weaving Sections Based on Micro Simulation*, Proceedings of the Third International Symposium on Highway Capacity, R. Rysgaard, editor, Road Directorate, Ministry of Transport, Denmark (publisher), 1998.

Chemical immobilization of *Candida antartica* lipase on photochemical activated polystyrene

Attaullah Bukhari*, Ani Idris,
Department of Bioprocess Engineering, Faculty of Chemical and Natural Resources Engineering,
Universiti Teknologi Malaysia , 81310 UTM Skudai, Johor, Malaysia
***Corresponding authors** Tel. +607-5535603, Fax. +607-5581463
Email: bukhari_ppk@yahoo.com, ani@cheme.utm.my

ABSTRACT
This work is focused to covalently immobilize Candida antartica lipase B (CALB) on activated polystyrene particles for the improvement of enzyme activity, stability and in particular to overcome the desorption of enzyme due to physically adsorbed on support. Polystyrene can be activated by a rapid and simple method using 1-fluoro-2-nitro-4-azidobenzene (FNAB) in a photochemical reaction. Immobilization of CALB on activated polystyrene particles will be performed in phosphate buffer solution (PBS) at PH 6.8.The percentage of loading of CALB on polystyrene particles will be calculated as the weight fraction of enzyme in catalyst. Enhanced enzyme activity is expected due to higher %loading of CALB on support particles and less external diffusional limitations.IR microspectroscopy and DMSO/aqueous Triton X-100 treatment are supposed to confirm covalent attachment between enzyme and activated polystyrene particles. Following the optimization of the process, a detailed comparison of the activity of native CALB and that of covalently immobilized CALB on polystyrene (CALB-PS) particles intend to assess for L-Lactide ring opening polymerization in non-aqueous medium (isooctane).Catalyst reused reaction cycles for L-Lactide ring opening polymerization, will be used to established the operational stability of preparation at optimum temperature. These findings will have significant implication for industrial application of CALB catalyzed polyester synthesis.

Keywords
Chemical immobilization, immobilization; desorption of enzyme; Photoactivated polystyrene; *Candida antartica* lipase B immobilized on polystyrene (CALB-PS)

INTRODUCTION
Lipases (E.C. 3.1.1.3) constitute a group of enzymes that catalyze the hydrolysis of lipids in biological systems [1]. In organic media, the enzymatic behavior changes and the enzyme can be used for the synthesis of different lipids [2].The versatility of these enzymes leads to several industrial applications in food and flavor making, Pharmaceuticals, synthesis of carbohydrate ester, amines and amides, cosmetics, among others [3]. These enzymes present a complex catalytic mechanism, called interfacial activation.

Model lipase Candida *antarctica* lipase B (CALB) a biocatalyst known for its efficiency and highly selectivity is used in a wide range of applications replacing industrial synthetic processes such as kinetic resolutions, aminolysis, esterification, transesterification, [4-6] hydrolysis in water, esterification in organic solvents, enantio- and regioselective transformations of many low molar mass and polymer substrates that possess a broad range of catalytic activities suitable for biotransformation [7-9]. CALB is not as efficient as other lipases in hydrolyzing triglycerides; however, it is highly stereospecific towards both ester hydrolysis and synthesis, due probably to a limited space available in its hydrophobic pocket. It also plays an important role in the synthesis of glucolipids [2, 10, and 11]. The substrates active sites consist of an acyl binding pocket, and small and large moiety of secondary alcohols binding pockets. Unlike most lipases, the entrance to CALB active site has no hindrance and does not exhibit interfacial activation [12].

Immobilized enzymes offer some operational advantages over soluble enzymes, such as choice of batch or continuous processes, rapid termination of reactions, controlled product formation, ease of removal from the reaction mixture and adaptability to various engineering designs [13]. Immobilization is therefore often the key to improve the operational performance of an enzyme [14]. Immobilization technique, conditions employed during immobilization, type of support, nature of solvent and variety of reactor intensively influenced the properties of immobilized enzymes. Hence properties of enzyme can be design via immobilization for a particular application.

Immobilization methods can be roughly divided into different categories: non-covalent adsorption, deposition, single covalent attachment, multiple covalent attachments, entrapment in a polymeric gel in membrane or capsule, cross-linking of an enzyme (such as CLEA, CLECs) and enzyme crystals (ECLs). Amongst these methods, physical (non-covalent) adsorption is one of the more simpler and inexpensive immobilization techniques. Lipases have an affinity for water/oil interfaces thus hydrophobic binding of lipases by adsorption has proven to be successful.

Many researchers have reported immobilization of CAL-B on various organic and in organic supports. Inorganic supports have some advantages like insensitivity to microbial degradation, better thermal stability and low cost.

A number of publications [15, 16, 17, 18, and 19] supported that adsorption method has been used widely to immobilize CAL-B and mainly focused on enhancement of enzyme activity, operational stability, thermal stability and conformation of enzyme. However the leaching (stripping) of immobilized enzymes which not only contaminate the product even increase the total production cost of product, has not been notified intensively and circumvent to date.

Commercially available preparation (Novozyme 453) CALB is immobilized on the resin (Lewatit OC 1600) that is a macroporous, divinlybenzene-crosslinked polymer based on methacrylic ester. According to literature the enzyme loading is between 8.5 and 20% (w/w). The lipase is loaded in a 50-100 μm wide front in the outer part of the beads [20, 21].This product is mainly embattled for the resolution of chiral intermediates and other high-price specialty chemicals where cost is less important than the performance and purity of catalyst. Indeed, numerous publications document the utility of Novozym 435 as an extraordinary catalyst for both small organic molecules and, more recently, for polymerization reactions. However, Bo Chen, Jun Hu et al, claimed that Novozym 435 suffers from physical desorption or leaching of CALB during reactions (unpublished results) [22].

Recently Hua Zhao and Zhiyan Song observed a number of compounds migrated from Novozyme 435 into organic solvents and ionic liquids. Five major compounds glycerol, benzoic acid, 2-hydroxyethyl benzoate, 2-hydroxyethyl sorbate, and sorbic acid are reactive in the presence of CALB; especially the last four compounds are potential acyl donors in enzymatic (trans) esterification reactions [23]. In some applications, such as for medical materials, protein contaminants in products may be offensive. Furthermore, processes that oblige multiple reuse cycles of Novozym 435 will be unattainable if substantial leaching of CALB occurs.

In recent times Nemanja Milletic et al. physically adsorbed CALB on hydrophobic polystyrene nanoparticles at pH 6.8 (isoelectric point) and found higher hydrolytic activity than Novozyme 435 [16]. Even though adsorption of CALB on polystyrene nanoparticles is simple and economical, they did not show thermal stability and desorption concern. Chemical and thermal stability of immobilized enzymes play important roles in organic synthesis. There is more risk for enzyme leaking that will disrupt the heterogeneous nature of the reaction. The type of immobilization is a significant parameter in understanding leaching effects.

As physically adsorbed enzymes are more susceptible to displacement, with loss of activity of CALB when immobilized on hydrophobic supports, therefore it is critical to find suitable ways to use CALB in organic synthesis on industrial scale so as to give it a clear advantage over conventional catalysts. One more drawback is that there is no specific binding by substrate or contaminants to the carrier which may result in diffusion restrictions and mass transfer problems.

This emphasize the need to develop chemically immobilize CALB catalyst that can circumvent the encountered problems while providing comparable activity for a wide range of biotransformation and in an economical way to make it realistic for industrial use. However there is limited number of reports regarding covalent immobilization of CALB in the part of literature. Palomo et al. immobilized CALB on various activated carriers including octyl sepabeads, PEI-agarose, glyoxyl-agarose, glutaraldehyde-agarose, Eupergit-Cu and glutaraldehyde derivative and established high enantioselectivity [24] Lozano, P. et al. also, attached CALB covalently on dynamic membranes deposited with two water-soluble polymers (gelatin and/or polyethyleneimine, PEI) and activated glutaraldehyde on a ceramic a- alumina support. CALB dynamic membranes showed excellent operational stability in anhydrous media.

An increased surface area, less external diffusional limitations and reduced catalyst volume of nanoparticles endorsed it an attractive support for the immobilization of CALB. This research work deals with preparation polystyrene nanoparticles and its use as novel support to chemically immobilized CALB for organic synthesis.

MATERIALS AND METHODS

Materials

CALB powder recombinant form was purchased from Sigma. Polystyrene (Mw=100,000) was purchased from Polyscience, Inc USA and Pluronic® F-68 was purchased from Sigma-Aldrich, Germany. FNAB (CAS no.: 28166-06-5) from Aldrich. As solvent tetrahydrofurane p.a. (THF) from Merck, Germany was used. All chemicals were used as supplied.

Methods

Preparation of polystyrenen (PS) nanoparticles

PS nanoparticles will be prepared by nanoprecipitation process. [25]. PS (Mw=100,000) will be dissolved in THF to a concentration of 0.45 wt %. Concentration of Pluronic® F-68 in the aqueous phase is supposed to 2.5 g/l. The aqueous phase will

be continuously stirred at two different stirrer rate of 500 and 600 rpm. The polymer phase will be introduced into the aqueous phase by a syringe pump at a feed rate of 53 ml/h. As the particles formation complete immediately, the suspension will be filtrated through a metal filter of 32 μm mesh size and the solvent will be removed from the suspension under vacuum in a rotating evaporator at 30 °C to a final volume of about 30 ml. Purification of the suspension can be performed by filtration on Sepharose Cl-4B (Aldrich, 40-165 μm). Afterward freeze drying will be performed.The shape of the nanoparticles will be observed using a scanning electron microscopy (SEM).Nanoparticles can be made conductive by evaporating a layer of 2 nm Platinum/Palladium alloy onto the surface.

Activation of nanoparticles

PS nanoparticles are put in petri dish and FNAB (15 umol/50ul methanol) was added to petri dish and kept in a fume cupboard and methanol was allowed to evaporate in the dark at room temperature. FNAB coated PS nanoparticles are exposed to UV light for 15-20 minutes at wavelength 365 nm. After this PS nanoparticles will be washed thoroughly with methanol, dried and used for CALB immobilization.

Coupling of enzyme to activated PS nanoparticles

Weighed amount of PS nanoparticles will be added in 5 ml vials. The vials will be filled with an enzymatic solution of different dilutions (400.200, 100,50,25,12.5 ng/ml of 100 mM PBS buffer (pH 6.8, 7.0 8.0, 9.0, 9.5,10 and 11). All the vials will be incubated for different durations (40 min, 1h, and 2h) at different temperatures (25°C, 30°C, 35°C, 37°C, 40°C). The suspension will be centrifuged and the mother liquor was removed from each vial. The solid was washed with adequate PBS buffer and distilled water, centrifuged and the liquid removed. This procedure should be repeated until no protein will be detectable any more in the washing solution. The mother liquor and the resulted washing solutions will be collected and using the BSA protein assay. The percentage of loading of CALB on polystyrene particles will be calculated as the weight fraction of enzyme in catalyst. IR microspectroscopy and DMSO/aqueous Triton X-100 treatment are supposed to confirm covalent attachment between enzymes and activated polystyrene particles. The resulting CALB-PS nanoparticles will be dried at vacuum at 10 min then used for organic synthesis. Enhanced enzyme activity is expected due to higher %loading of CALB on support particles and less external diffusional limitations.

Poly L-lactide synthesis

Activity of immobilized CALB-PS is intended to be calculated in terms of nmol LLA (L-lactide acid)/min/mg CALB-PS). Activity of immobilized CALB-PS is supposed to assayed by L-Lactide ring opening polymerization in non-aqueous medium (isooctane) by using 10-15 wt % of biocatalyst relative to monomers and 70 wt% of LLA(L-lactide acid ,monomers) relative to isooctane. Operational stability of the immobilized enzyme will be also assayed by using 10-15 wt % of the biocatalyst in successive batches of poly-L lactide synthesis. At the end of each batch, the immobilized lipase will be recovered from the reaction medium and rinsed with isooctane (20 mL), in order to extract any substrate or product retained in the matrix. After 1 h at room temperature, the immobilized enzyme would be used in fresh medium. The residual activity of CALB-PS will be calculated in terms of percentage of activity (U) of the immobilized enzyme calculated after each cycle compared with the activity of CALB-PS before the first cycle.

EXPECTED RESULTS AND DISCUSSION

FNAB coated PS nanoparticles are subjected to UV treatment. The azido group of FNAB upon UV excitation is transformed into a very much reactive nitrene which inserts into the C–H bonds of the polymer by a covalent linkage while the active fluoro group of FNAB, now part of the polymer, remains intact. The activated polymer binds with the protein following displacement of its fluoro group by the amino group of the protein producing an immobilized CALB-PS [26].

Polystyrene will be synthesized in the shape of nanoparticles. Scanning electron microscopy (SEM) illustrations are expected to shows the spherical shape of nanoparticles [27].To evaluate the changes in the surface provoked by the activation process, PS nanoparticles will be analyzed by scanning electron microscopy (SEM). IR microspectroscopy and DMSO/aqueous Triton X-100 treatment are supposed to confirm covalent attachment between CALB and activated polystyrene particle. Activity of immobilized CALB-PS is intended to be calculated in terms of nmol LLA (L-lactide acid)/min/mg CALB-PS).

Effect of pH of CALB solution during coupling of CALB, on enzyme activity and enzyme loading

Ph of enzyme solution during coupling of enzyme onto support has very pronounced effect on enzyme loadings and enzyme activity of immobilized enzyme. Enzyme conformation “very critical for enzymatic activity” change with pH value [28 29].The highest enzyme activity has been reported near isoelectric point of enzyme (pI 6.0) due to immobilization of enzyme in its active configuration [30].In this work enhanced enzyme activity at pH 7.0 is most likely would be attributed to the factors, coupling of enzyme in active conformation, higher % loadings and less diffusional limitations among substrate, enzyme and

product unlike the diffusion limitations encountered in porous supports **fig.1**. Further increase in pH value results in unfavorable charge distribution on amino acids residues that cause the decrease in enzyme activity [31].Maximum loading is expected at pH 10 and 11**Table 1**.The pKa values of lysine residues on the surface of CALB surface (pKa 10.5) favors the multiple attachments [32]. Although at higher pH values thermal stability is supposed to enhance due to multiple attachments between CALB and PS nanoparticles while enzyme activity is expected to be lower due to increased rigidity and deposition of enzyme on previously attached enzyme.

Table 1.Loading of CALB on PS nanoparticles and its activity at various pH values

pH	Loading ug.mg^{-1}	Enzyme activity nmol LLA/min/mg CALB-PS
6	150	50
7	180	70
8	190	30
9	200	20
10	220	10
11	230	00

Effect of contact time, thermal stability and activity of immobilized CAL-B on PS nanoparticles

Optimum enzyme activity is being expected at pH 7.0 after 1 hour of contact time between support and enzyme. Literature supports these results, suggesting the covalent attachment [33].Increasing the contact time would have no effect on enzyme activity **fig.2**. However after 1 hour at pH 10.0 decrease in activity is possible due to factors, multiple attachments [33], increased rigidity of proteins and deposition on chemically attached enzyme formerly **fig.3**.Even though, a direct relationship between multipoint attachments and thermal stability has been reported [34, 35] while at pH 10.0, more rigidity, distortion in secondary structure of proteins may be much significant factors lower the enzyme activity. In this work activation profile of CALB-PS at 60-70°C is supposed to investigate in organic media.

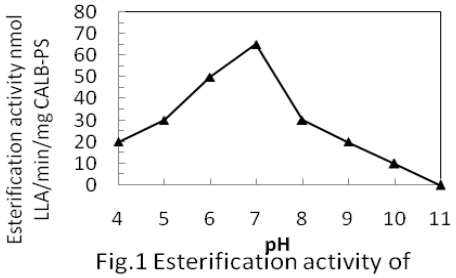


Fig.1 Esterification activity of CALB-PS

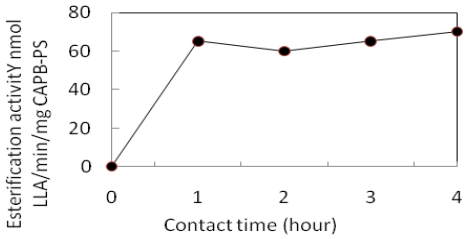


Fig 2 Esterification activity at pH 7.0

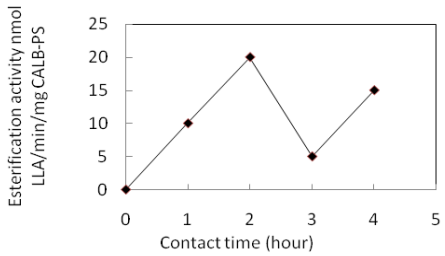


Fig. 3. Esterification activity at pH 10.0

CONCLUSION

In this work CAL-B is expected to chemically immobilize successfully on polystyrene nanoparticles prepared by nanoprecipitation. Optimum activity near isoelectric point is expected due to the coupling of enzyme in its active conformation. After 1hour of contact time between support and enzyme at Ph 7, single covalent attachment between support and enzyme is at its maximum level. The higher thermal stability to be expected when immobilized enzyme would be prepared at pH 10.0 possibly will be due to the formation of a multipoint covalent attachment between active groups of the support and the lysine residues of the enzyme. Nevertheless, at the same time decreased in enzyme activity most likely due to increased rigidity of enzyme. However, best results of operational stability of synthesis and storage are expected when lipase is covalently immobilized at pH 7.0.In this work we are intended to demonstrate that PS nanoparticles as a novel support compatible for covalent immobilization of CALB, rendering a biocatalyst more stable and highly active ,that can be used in aqueous or organic media.

REFERENCES

[1] Martinielle, M.,Holmquist,M.,Hult,K., Biochim. Biophys. Acta 1258 (1995) 272.
[2] Uppenberg,J., Hansen,M. T.,Patkar ,S.,Jones,T . A., Structure 2 (1994) 293.
[3] Hung,T . C.,Giridhar ,R., Chiou,S. H.,W u,W . T., J. Mol. Catal. B-Enzym. 26 (2003) 69.
[4] A. Ghanem, Tetrahedron 2007, 63, 1721
[5] E. M. Anderson, M. Karin, O. Kirk, Biocatal. Biotransform. 1998, 16, 181.
[6] R. D. Schmid, R. Verger, Angew. Chem., Int. Ed. 1998, 37, 1609. [B] Anderson EM, Larsson KM, Kirk O: One biocatalyst - Many applications: The use of

Candida antarctica B-lipase in organic synthesis. Biocatal Biotransfor 1998, 16(3):181-204.

[7] Hasegawa, S. et al. (2008): Enzymatic esterification of lactic acid, utilizing the basicity of particular polar organic solvents to suppress the acidity of lactic acid. J. Chem. Technol. Biotechnol. 83, 1503–1510

[8] Schwab, L.W. et al. (2008) Enzyme-catalyzed ring-opening polymerization of unsubstituted b-lactam. Macromol. Rapid Commun. 29, 794–797

[9] [9]. Lassalle, V.L. and Ferreira, M.L. (2008) Lipase-catalyzed synthesis of polylactic acid: an overview of experimental aspects. J. Chem. Technol. Biotechnol. 83, 1493– 1502

[10] Palomo,J. M.,Mun õz,G.,Lor ente, G. F., Mateo, C., Fernandez- Lafuente,R.,Guisán, J. M., J. Mol. Catal. B- Enzym. 19-20 (2002) 279.

[11] Bornscheuer,U. T.,Bessler ,C.,Srinivas,R., Krishna,S. H., Trends Biotechnol. 20 (2002) 433

[12] Martinelle M, Holmquist M, Hult K: On the interfacial activation of Candida antarctica lipase A and B as compared with Humicola lanuginosa lipase. Biochim Biophys Acta 1995, 1258(3):272-276.

[13] Adriano,W . S.,Costa Filho,E. H.,Silva,J. A.,Gonçalves, L. R. B., Braz. J. Chem. Eng. 22 (2005) 529.

[14] Sheldon, RA. 2007. Enzyme immobilization: The quest for optimum Performance. Advanced Synthesis & Catalysis 349(8-9):1289-1307.

[15] P. Roach, D. Farrar, C. C. Perry, J. Am. Chem. Soc. 2005, 127, 8168.

[16] Nemanja Miletic´, Volker Abetz, Katrin Ebert, Katja Loos Immobilization of Candida antarctica lipase B on Polystyrene Nanoparticles: Macromol. Rapid Commun. 2010, 31, 71–74

[17] M.L. Foresti b, G. Valle a, R. Bonetto a, M.L. Ferreira , L.E. Briand ; FTIR, SEM and fractal dimension characterization of lipase B from Candida antarctica immobilized onto titania at selected conditions: Applied Surface Science 256 (2010) 1624–1635

[18] Quiocho FA, Richards FM: Intermolecular cross-linking of a protein in the crystalline state: carboxypeptidase A. Proc Natl Acad Sci USA 1964, 52:833–839

[19] B. L. A. Prabhavathi Devi Æ Zheng Guo Æ Xuebing Xu (2009) Characterization of Cross-Linked Lipase Aggregates J Am Oil Chem Soc (2009) 86:637–642 ,DOI 10.1007/s11746-009-1401-8

[20] [20]. Chen, B, Hu, J, Miller, EM, Xie, W, Cai, M, Gross, RA. 2008. Candida antarctica Lipase B chemically immobilized on epoxy-activated micro- and nanobeads: catalysts for polyester synthesis. Biomacromolecules 9(2):463-471.

[21] Nakaoki, T, Mei, Y, Miller, LM, Kumar, A, Kalra, B, Miller, ME, Kirk, O, Christensen,M, Gross, RA. 2005. Candida antarctica lipase B catalyzed polymerization of lactones: Effects of immobilization matrices on polymerization kinetics & molecular weight. Industrial Biotechnology 1(2):126-134.

[22] Bo Chen, Jun Hu, Elizabeth M. Miller, Wenchun Xie, Minmin Cai, and Richard A. Gross,Candida antarctica Lipase B Chemically Immobilized on Epoxy-Activated Micro- and Nanobeads: Catalysts for Polyester Synthesis, Biomacromolecules 2008, 9, 463–471

[23] Hua Zhao, Zhiyan Song Migration of reactive trace compounds from Novozym® 435 into organic solvents and ionic liquids Biochemical Engineering Journal 49 (2010) 113–118

[24] Palomo, J. M.; Fernandez-Lorente, G.; Mateo, C.; Manuel, F.;Fernandez-Lafuente, R.; Guisan, J. M. Tetrahedron: Asymmetry 2002, 13, 1337–1345.

[25] W. Norde, Adv. Colloid Interface Sci. 1986, 25, 267.

[26] Utpal Bora, Lalita Chugh, Pradip Nahar: Covalent immobilization of proteins onto photoactivated polystyrene microtiter plates for enzyme-linked immunosorbent assay procedures

[27] Nemanja Miletic´, Volker Abetz, Katrin Ebert, Katja Loos: Immobilization of Candida antarctica lipase B on Polystyrene Nanoparticles Macromol. Rapid Commun. 2010, 31, 71–74

[28] P. Sabuquillo, J. Reina, G. Fernandez-Lorente, J. M. Guisan, R. Fernandez-Lafuente, Biochim. Biophys. Acta 1998, 1388, 337.

[29] J. M. S. Rocha, M. H. Gil, F. A. P. Garcia, J. Biotechnol. 1998, 66, 61.

[30] J. Uppenberg, M. T. Hansen, S. Patkar, T. A. Jones, Structure 1994, 4, 293.

[31] K. Loos, S. B. Kennedy, N. Eidelman, Y. Tai, M. Zharnikov, E. J. Amis, A. Ulman, R. A. Gross, Langmuir 2005, 21, 5237.

[32] Adriano, W. S., Costa-Filho, E. H., Silva, J. A., Giordano, R. L. C., and Goncalves, L. R. B. (2005), *Braz. J. Chem. Eng.* **22,** 529–538.

[33] ANA I. S. BRÍGIDA,1 ÁLVARO D. T. PINHEIRO,1 ANDREA L. O. FERREIRA,1 GUSTAVO A. S. PINTO,2 AND LUCIANA R. B. GONÇALVES Immobilization of *Candida Antarctica* Lipase B by Covalent Attachment to Green Coconut Fiber*Applied Biochemistry and Biotechnology Vol. 136–140, 2007*

[34] Otero, C., Ballesteros, A., and Guisan, J. M. (1988), *Appl. Biochem. Biotechnol.* **19,** 163–175.

[35] Pedroche, J., Yust, M. M., Mateo, C., et al. (2007), *Enzyme Microb. Technol* in press.

Effect of Lateral Confining Systems in Transverse Behavior of Slabs over Tee Girder Bridges

Babak Karimpour, Redzuan Abdullah
Department of Civil Engineering, University Technology of Malaysia
Babak_742001@yahoo.com

ABSTRACT

The objective of this study was to determine the effect of different intermediate diaphragms and ties on the slab transverse reinforcement stress (STRS) over T girders. The linear finite element modeling scheme was used to evaluate more than 100 finite element bridge models. The results showed that the slab behavior was largely influenced by the shape and stiffness of diaphragms and ties conditions.

Keywords

Bridge, Diaphragm, Tie, Slab, girder, Finite element model

INTRODUCTION

Increase in shear capacity develops with compressive membrane action in a concrete deck. Also, in a laterally restrained concrete deck slab, compressive membrane action occurs. Improved lateral restraint of the deck, achieved by tying laterally stiff girders together with steel rods, further enhances the shear capacity. The lateral confining system types that were used in this study in the bridge model include concrete diaphragm, steel X-braced, steel K-braced and single ties.

Details of models: The depth of the concrete deck is 200mm, girder center-to-center spacing is 1800mm and the clear span of the deck is 1m.Also, 24mm, reinforcing bars, 200 mm spacing, are used as slab transverse reinforcement at the bottom. In model1 the concentrated load was assigned at the middle location of the bridge span. (122.5e3N) and the dimensions of the test slab are 4400 mm (width) x 5000 mm (length).Also, in model2,the truck load include 16 concentrated wheel load were assigned at the middle of span. (Each load, 122.5e3N base on vehicle loading, UK standard for single wheel load) and the dimensions of the test slab are 8000 mm (width) x 12000 mm (length).

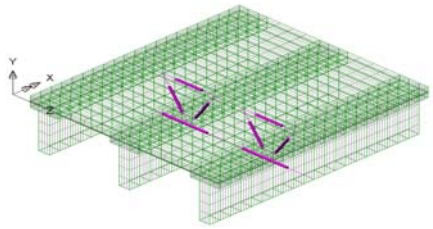
Analysis of model1Steel X-braced and K-braced diaphragms

The simplified models for the K-braced and X-braced, intermediate diaphragms were made by representing the diagonal members and horizontal struts with truss-type, finite elements.68mm, tie bar were used in all of the members in the K-braced and X-braced intermediate diaphragms.

Diaphragm location (mm)	Diaphragm Type	STRS (kg/cm^2)
X=3000	Steel X-braced with horizontal strut diaphragm	2924
X=3000	Steel X-braced without horizontal strut diaphragm	3232
X=2100, 3900	Steel X-braced with horizontal strut diaphragm	3166
X=3000	Steel K-braced diaphragm	3066

Table1: STRS (kg/cm^2) in bridge with intermediate diaphragm

Figure 1: Steel K-braced intermediate diaphragm



Concrete intermediate diaphragms systems

In order to analyze the depth effect of intermediate diaphragms on the slab response of the bridge, five different cases with the thickness of 200mm and different depth are analyzed. The diaphragms start from the underside of the bridge slab. Also, the effect of thickness of the intermediate diaphragms is studied and the cases of different thickness with full depth are simulated .In full depth diaphragm, the diaphragm starts from the underside of the bridge slab and extends down to the vertical face of bottom flange for the girders.

Table2: STRS (kg/cm^2) in concrete diaphragm (t=200mm)

Diaphragm dimension mm	Diaphrag m Location	Diaphrag m Height	STRS (kg/cm^2)
1305*1500+160*1000	From y=-160 to y=-1165	1005	2557
1005*1500+160*1000	From y=-160 to y=-1465	1305	2626
705*1500+160*1000	From y=-160 to y=-865	705	2741
405*1500+160*1000	From y=-160 to y=-565	405	2883
105*1500+160*1000	From y=-160 to y=-265	105	3077

Table3: STRS (kg/cm^2) in concrete)

Diaphragm thickness	STRS (kg/cm^2)
100mm	2690
150mm	2602
200mm	2557
250mm	2544
300mm	2526
350mm	2515

Effect of the ties number on slab behavior

The effect of the number of ties is evaluated by FE of models that include 1-5 ties (with 68mm diameter). The locations of the ties are vertical face of bottom flange for the girders.

Ties number in each lane	1	2	3	4	5
Location (mm)	middle	X=2100 , 3900	X=2100 , 3000, 3900	X=1200, 2100, 3000, 3900	X=1200 , 2100, 3000, 3900, 4800
20mm tie bar	3352	3338	3307	3303	3301
40mm tie bar	3294	3285	3259	3257	3257
68mm tie bar	3268	3263	3241	3241	3241
100mm tie bar	3259	3257	3234	3234	3234

Table4: Amount of STRS (kg/cm^2) based on ties number

Effect of end diaphragms on slab behavior

In this section, in order to analyze the effect of end diaphragms on the slab response of the bridge, a bridge with one concrete intermediate diaphragm (CID) at the middle of span and two end diaphragm (ED) with the thickness of 200mm is analyzed. Also, two cases of concentrated load location are evaluated: (a) at ½ point of span, and (b) at 1/3 points of span. The results are compared with the case of bridge without end diaphragm.

Table5: Effect of end diaphragms on STRS (kg/cm^2)

	Bridge without (ED) and with one CID and middle span load	Bridge with (ED) and with one CID and middle span load	Bridge with just (ED)
Middle span load	2557	2555	3436
1/3 span load	3188	3153	3404

Effect of load increase on slab behavior

The effect of increasing in concentrated load amount on the slab is studied in this section by increasing the middle span load in all of lateral confining systems. In all of the intermediate diaphragms the load increase from 112.5e3 to 146.2e3 and the loads were applied at the middle of span.

Table6: Effect of load increase (N) on STRS (kg/cm^2) and slab concrete stress

Lateral Confining system	STRS, p=112.5 e3N	STRS, p=146.2e 3N	Slab Concrete Stress, p=112.5e 3N	Slab Concrete stress, p=146.2e3 N
Without ties	3440	4427	29.68	38.58
Steel X-braced with horizontal strut diaphragm	2924	3770	29.71	38.62
Steel K-Braced diaphragm	3066	3947	29.71	38.61
3 tie bar 68mm	3252	4190	29.69	38.58
Concrete diaphragm(b) (t=200)	2557	3288	29.67	38.56

Effect of load locations on slab behavior

In this section the effect of moving the load location from middle of span to 1/3 of span was considered. In all models the diaphragms located at the middle of the span.

Table7: Effect of load location on STRS (kg/cm^2)

Diaphragm location (mm)	Diaphragm type	STRS(load in 1/2span)	STRS (load in 1/3span)
X=3000	Steel X-braced with double horizontal strut diaphragm	2924	3250
X=3000	Steel K1-braced diaphragm	3066	3261
X=3000	RC diaphragm(b), full depth,200mm thickness	2557	3153

Table8: Effect of load location on STRS (kg/cm^2) in tied systems

Diaphragm location (mm)	Tie section	STRS(load in 1/2span)	STRS (load in 1/3span)
X=2100,3000, 3900	3 tie bar 68mm	3252	3255

Effect of load location movement in Z direction on slab behavior

In this section the effect of moving the load location from middle of span in z direction (z=3050) to between two girders (z=4100) was considered. In all of the models the diaphragms located at the middle of the span.

Table9: Effect of load location on STRS (kg/cm^2)

Diaphragm type	STRS (load located at z=3050)	STRS (load located at z=4100)
3 tie bar 68mm X=2100,3000, 3900	3252	2555
Steel X-braced with double horizontal strut diaphragm	2924	2544
Steel K1-braced Diaphragm	3066	2542
Concrete diaphragm(b), full depth,200mm thickness	2557	2396
Concrete intermediate and end diaphragm(b), full depth,200mm thickness	2555	2396

Analysis of model2

In this section, in order to analyze the effect of lateral confining systems on the slab which loaded by a truck load(HB vehicle load, based on united kingdom code), the strain of the slab(equivalent strain, Von Mises) and slab displacement(resultant displacement) were determined in slabs with different lateral confining systems.

Table10: Effect of load location on STRS (kg/cm^2)

Diaphragm type	Equivalent strain (Von Mises) *1000	Resultant displacement (mm)
Without lateral confining system	.369	1.8
Tie bars 68mm (every 900mm)	.354	1.71
Steel X-braced with double horizontal strut (every 3000mm)	.294	1.227
Steel X-braced without double horizontal strut (every 3000mm)	.318	1.39
Steel K1-braced (every 3000mm)	.322	1.735
Concrete, full depth,200mm thickness (every 3000mm)	.287	1.234

CONCLUSIONS

From model 1:

Effect of ties number: Based on the observation from the simulation, the effect of ties number in slab reinforcement stress reduces is significant. there is a gradual decrease in slab reinforcement stress between the bridges without any ties and the bridges with one tie at the middle of span (around 5%).In addition, the percentage go up to 6% in case of the number of ties equal to three. Interestingly , there is not any change in slab reinforcement stress with increasing the ties number from 3 to 5.As a result, a suitable number of ties is recommended that every one meter except than at the supports and near of them.

Effect of X-braced and K-braced intermediate diaphragm: On the whole, single steel intermediate diaphragms at the middle of the span can decrease the slab reinforcement stress in maximum percentage to 15% in case of Steel X-braced with horizontal strut diaphragm and in minimum percentage to 6% in case of Steel X-braced without horizontal strut diaphragm. Also, base on finite element models, it is found that steel X-braced diaphragms are more effective than steel K-braced diaphragms.

Effect of concrete diaphragms: Generally, the result from F.E.M of the sample in this study show that, a single concrete diaphragm at the middle of the span can decreases the slab reinforcement stress in maximum percentage to 26% in case of full depth concrete diaphragm with 200mm thickness and in minimum percentage to 11% in case of 8% depth and 200mm thickness. It shows that the effect of concrete diaphragm depth is quite noticeable. In addition, by increasing the concrete diaphragm thickness from 100mm to 350mm it is observed that the slab reinforcement stress decrease as 6.5%. In summary, both the thickness and depth of the concrete diaphragm have important effect on slab reinforcement stress.

Effect of end diaphragms on slab behavior: As demonstrated for the finite element bridge cases, there is no significant difference in slab reinforcement stress in bridges that include one intermediate diaphragm, in case of bridge with and without diaphragm. Also, in term of use of just end concrete diaphragms, there is not any decrease in slab reinforcement stress in case of models that the single load applies at the middle of span. However, in case of models that the single load applies at the 1/3 of span it can cause just 1 %decreasing in slab reinforcement stress in comparison with the samples that not include any diaphragm.

Effect of applied load increase (load in middle) on slab behavior: Interestingly, based on the observation from the simulation, there are not any differences in increase percentage of slab reinforcement stress and slab concrete stress by increasing the applied load as 30% in all of the confining systems (steel and concrete diaphragm).

Effect of load locations on slab behavior: Base on the finite element models, when the load was applied away from the diaphragm location (in 1/3 of span), the slab reinforcement stress increased from 1.4%in Steel K2-braced diaphragm until 23.3% in RC diaphragm.

Effect of load location movement in Z direction on slab behavior: Based on the observation from the simulation, the effect of load location movement in Z direction from middle of span in z direction (z=3050) to between two girders (z=4100) is significant. This phenomenon can be assumed as the effect of change in load transferring from slab to the beam with change in load location. In second load location (between two girders) the arching action in load transferring is occur and the load transfer more than arching action rather than bending alone. Therefore, by decreasing the bending action, the slab reinforcement stress will be reduced.

From model 2: As demonstrated for the finite element bridge case which loaded by truck load, the concrete diaphragms have significant effect on strain and displacement of the slabs and decrease them 22% and 31% respectively. In addition, Steel X-braced with double horizontal strut diaphragm reduce the amount of strain and displacement of the slabs for 20% and 32% respectively.

Designing Economical Production of Microbial Cellulose from Waste Using Modified Bioreactor

Khairul Azly Zahan*, Mohd Fadhrullah Mohd Sani, Norhayati Pa'e,
Ch'ng Chia Hui and Ida Idayu Muhamad
Department of Bioprocess Engineering, Faculty of Chemical Engineering,
Universiti Teknologi Malaysia, 81310 Skudai, Johor
khairulazly@gmail.com

Abstract
Microbial cellulose produced by Acetobacter xylinum is an alternative source for plant cellulose in industrial use. Production of microbial cellulose is receiving great attention since they can be applied in many fields. This research is carried out to study the production of microbial cellulose using Rotary Discs Reactor (RDR) by Acetobacter xylinum bacteria in pineapple waste medium. RDR is a new method developed to enhance the production of microbial cellulose in industrial field because of few advantages: it allows the oxygen enrich air to be supplied continuously, homogenized culture in the medium by rotating discs and less hassle to scale up. This research involved few experimental works including fermentation process, comparison of the production yield from static culture and RDR using similar medium, and glucose analysis. The fermentation process was carried out at room temperature, pH 5.0, rotary speed at 7 rpm and 4 days of fermentation. The variable parameter in this research was waste pineapple concentration which varied from 20% (v/v) to 100% (v/v). Results show that microbial cellulose production in the medium with 20% (v/v) of waste pineapple concentration was the highest value which is 255.85 gram among others.

Keywords
Microbial Cellulose, *Acetobacter xylinum*, modified bioreactor, waste to wealth

INTRODUCTION

Nowadays, the most usual method for production process of microbial cellulose had used static cultivation methods, with pellicles of microbial cellulose being formed on the surface of the static culture. But, there are some issues that prevented larger scale production as high price substrates, low volumetric yields, long time consumption, laborious and the up-scale process for high yield is limited. Studies showed that there is an alternative method to improve this problem by using Rotary Discs Reactor (RDR). This research is focused on the evaluation on static culture and using Rotary Disc Reactor in production of microbial cellulose from different concentration of pineapple waste to ensure high yield and high quality of microbial cellulose produced. The RDR use the concept of rotating biological contactor that exposed bacteria to the air for better aeration and used multiple discs that rotate to give better aeration to the bacteria (Norhayati, 2009).

In this study, pineapple waste had been used as a subtrate to produce microbial cellulose. In pineapple industries, only 20% were used to produce product while another 80% is the waste. A method of turning this waste to wealth is producing microbial cellulose from the liquid waste using fermentation by bacteria *Acetobacter xylinum*. The culture characteristics of the bacteria that being identified as optimal were at temperature of about 28°C, pH 4.0 to 5.0, ammonium salts as nitrogen source and either glucose or sucrose as carbon source (Alina, et.al, 2005, Verschuren et. al., 2000, Keshk and Sameshima, 2005, Budhiono, 1999).

METHODOLOGY

Materials

The inoculums culture (starter culture) used, was obtained from MARDI, UPM. Pineapple waste was obtained from Lee Pineapple PTE LTD (Johor) and pressed as liquid waste. The main equipment use is the designed and modified Rotary Discs Reactor (RDR). All chemical used were of analytical grade.

Experimental Method

The Rotary Discs Reactor (RDR) used in this project is shown in the Figure 1. The RDR was covered with aluminum foil to close the entire hole which can cause contamination. Eight series of discs made from aluminum was mounted in the RDR. About 40% of the discs were immersed in the medium after the medium filled in the RDR. The discs diameter is 7.0 cm while the active surface area of discs is 575.2 cm^2. The total volume of RDR is 2000.0 cm^3 with working volume of 1000.0 cm^3. The rotational speed is 7 rpm. The RDR placed under the UV for about 24 hours before experiment start to kill all the microorganisms which can cause contamination.

The preparation for starter medium for *Acetobacter xylinum* is put 20 ml of pineapple waste in a 200ml beaker. 80ml distilled water (to produce of waste pineapple concentration at 20% (v/v)) was added to the same beaker. Then, 0.8g yeast extract, 0.2g bactopeptone, 1.0g (1% (w/v)) sucrose, 0.2g ammonium sulfate ($(NH_4)_2SO_4$), 0.2g KH_2PO_4, 0.07g $MgSO_4$ was added into the medium. The medium was

stirred until homogenized and cooled to room temperature. The pH of the medium was adjusted with Acetic acid to pH 5.0 by using pH meter. Then, the medium was poured into a 200 ml Schott Bottle and closed the bottle with its lid. The Schott Bottle was placed into the autoclave at 121°C for 15 minutes. Then, the medium was cooled to room temperature and 10mL of *Acetobacter xylinum* (inoculum nata) was added into the medium using antiseptic technique. The solution was mixed apparently by shaking the Schott Bottle slowly. The starter medium was kept in refrigerator if not use. It shelf live can be last for 3 to 4 weeks. Then, repeated for a new stock culture with different waste pineapple concentration at 40 % (v/v), 60 % (v/v), 80% (v/v) and 100 % (v/v).

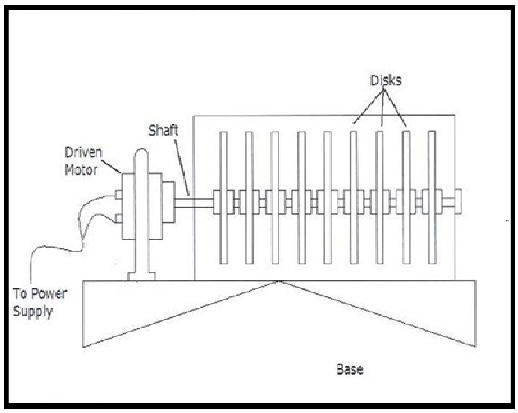


Figure 1 : Two dimension drawing of RDR

The preparation for RDR culture medium is put 200 ml of pineapple waste in a 1L beaker, 800 ml distilled water (to produce of waste pineapple concentration at 20% (v/v)) was added to the same beaker. 15.0g yeast extract, 2.0g bactopeptone, 10g (1% (w/v)) sucrose, 2.0g ammonium sulfate ($(NH_4)_2SO_4$), 1.5g KH_2PO_4, 0.25g $MgSO_4$ was added into the medium. The medium was stirred until homogenized and cooled to room temperature. Then, the pH of the medium was adjusted with Acetic acid to pH 5.0 by using pH meter. The medium was poured into a 1L Schott Bottle and closed the bottle with its lid. The Schott Bottle was placed into the autoclave at 121°C for 15 minutes. Then, the medium was cooled to room temperature and 100 mL of *Acetobacter xylinum* (inoculum nata) was added into the medium using antiseptic technique. The solution was mixed apparently by shaking the Schott Bottle slowly. The medium was poured into RDR. The RDR was covered with aluminum foil and leaved for 4 days at room temperature. After the microbial harvested, the RDR culture medium was repeated with different concentration of waste pineapple in the culture medium (20% (v/v), 40% (v/v), 60% (v/v), 80% (v/v) and 100% (w/v).

Determination of Wet Weight Cellulose and Dry Weight Cellulose

Harvest microbial cellulose washed with NaOH solution 2% (w/v) and washed again with plenty of water and dried with tissue. Recorded the wet weight and dried it in oven for 65°C for one day. Cooled to ambient temperature and recorded the dried weight.

Determination of Glucose Content of Microbial Cellulose

10 ml of the fermentation medium sample was taken out and centrifuged at 5000 rpm for 5 minutes to sediment the cells and other solutes. 3 ml of supernatants were carried out and added with 3 ml of 3,5-dinitrocylicsilic (DNS) and centrifuged thoroughly. The solution placed into water bath for 90°C for 15 minutes. After cooled to ambient temperature, 1 ml of potassium natrium tartarate was pipette into the solution for color stabilizing. Filled the solution into a Cell Cuvet and observed the optical density (OD) at 550 nm wavelength.

RESULTS AND DISCUSSION

Comparison between Static fermentation and RDR fermentation

Figure 2 shows microbial cellulose produced in RDR and static fermentation. For four days fermentation at fixed condition which is pH 5.0 and room temperature, RDR produced 255.85 gram wet cellulose while static culture gives only 13.66 gram. This shows that RDR achieved 94.66% more yield of cellulose than that from static fermentation. Result from experiment also shows that fermentation of RDR produced microbial cellulose with higher water content compared to static fermentation.

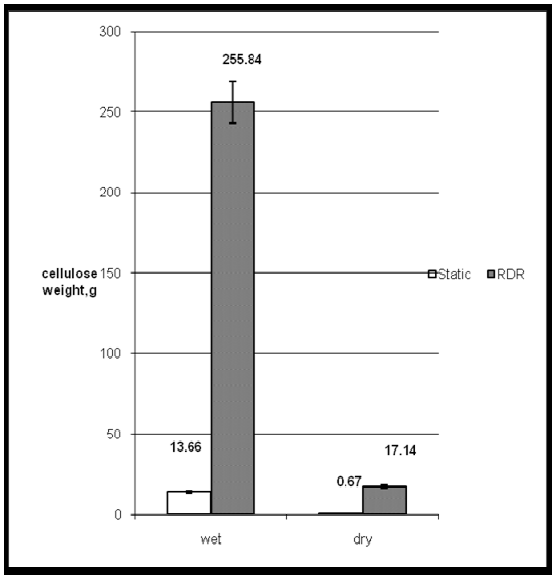


Figure 2: Cellulose produced between static and RDR fermentation after 5 days.

From statistical analysis, ANOVA Two Factor without replication had been run in order to prove the ability of RDR to increase microbial cellulose production statistically. The result shows *p*-value equal to 0.0183 which is smaller than 0.05. The result also shows that F ratio value of the test is 52.894 which is larger compare to F critical value, 18.512. The F-test output proved that the difference between RDR and static fermentation is statistically significant. Therefore, the significant capability of RDR to produce higher yield of microbial cellulose was statistically proven.

One of the reason behind this significant increment is aeration factor. Previous studies reported that static culture had a difussion limitation problems. Microbial cellulose film that produced at the surface of medium will slowly restrict the diffusion of oxygen and nutrient. This will lead to inactivation or death of A*cetobactor xylinum* because lack of oxygen and food (Vandamme et al., 1997). In RDR, the discs rotate and let *Acetobactor xylinum* in contact with the medium and air during fermentation. This automatically reduces or perhaps eliminate the diffussion limitation problems as in static culture fermentation.

Another factor that lead to increasing of microbial cellulose production in RDR is the larger surface area. The cellulose production were found to be proportional to the surface area of the culture when volume were held constant (Masaoka, 1993). In RDR, the surface area for microbial cellulose to attach on are higher compare to static fermentation. In this study, with good discs packing, active surface area of RDR can form up to 2.5 times compared to static fermentation. Therefore, it is demonstrated that fermentation using RDR give better microbial cellulose yield compare to static fermentation. These phenomena are due to RDR gives better aeration for microbial cellulose production and at the same time provide larger surface area for liquid-air interface.

Effect of Initial Waste Pineapple Concentration on the Microbial Cellulose Productivity

The productivity of microbial cellulose produce in different initial concentration of waste pineapple has been determined. From figure 3, the graph shown after 4 days of fermentation, culture medium with 20 % (v/v) of initial waste pineapple concentration gave the highest yield of microbial cellulose with total wet weight of 255.85 gram, while the lowest yield of microbial cellulose production was obtained in the culture medium with 60% (v/v) of initial waste pineapple concentration with total wet weight of 129.32 gram.

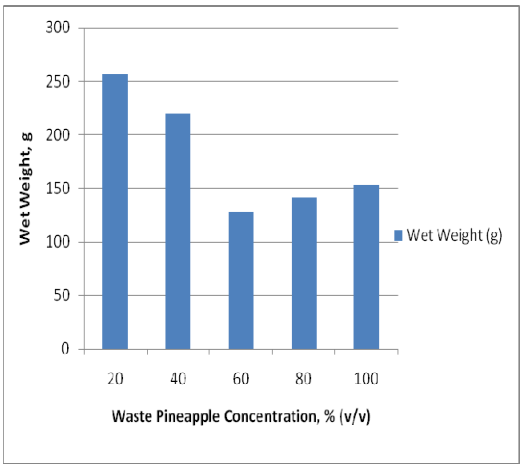


Figure 3 :Graph of Wet Weight of Microbial Cellulose Produced by RDR vs. Initial Waste Pineapple Concentration

On the other hand, the increasing of microbial cellulose production after 60% (v/v) was not significant because the total wet weight is low compare to the total wet weight when waste pineapple concentration is at 20% (v/v). The percentage difference for the total wet weight of the yield between the initial waste pineapple concentration was calculated. When the initial waste pineapple concentration is at 60% to 80% (v/v) the percentage diffrence is 10.34% and when the initial waste pineapple concentration is at 80% to 100% (v/v) the percentage difference is 7.25%. Hence, it can be concluded that the production become stationary and did not give significant increament when the initial waste pineapple concentration above 60% (v/v).

Ch'ng (2007) in her research using the same medium culture reported, the maximum yield of microbial cellulose produced in shaken medium culture with additional micro particles after optimization process was only 176.47 gram in 4 days incubation. While in static culture, she reported that the total wet weight produced was 13.66 gram in 4 days incubation. By comparing her result with the result obtained from this research, the production of microbial cellulose using RDR achieved 31.02% more yield than shaken culture with additional micro particles after optimization process and 94.66 % more yield then static culture in pineapple waste.

Other than that, fermentation with RDR also can reduce the initial concentration of sucrose which is the carbon source for the bacteria to produce the microbial cellulose. It is because, in Ch'ng (2007) research, in the same medium, she used 20 gram sucrose in shaken culture with additional of micro particles after optimization and for static culture medium, she used 4 gram of sucrose for culture medium of 400 mL. But, by using RDR, to produce

maximum yield of microbial cellulose, only 10 gram (1% w/v) of sucrose needed for 1 liters of culture medium. This low usage of sucrose can reduce the production cost in laboratory and also in industries sector.

Son et al., (2001) reported that microbial cellulose production decreased with an increase in the initial concentration of glucose source. Finally, the result obtained for the total wet weight of microbial cellulose production were in agreement with their reseacrh because pineapple waste content high concentration of glucose. It is the reason, at 20% (v/v) of initial waste pineapple concentration produced the higher yield of microbial cellulose.

CONCLUSION

As a conclusion, this research project is successfully fulfilling the research objective which is to determine the optimum culture condition of Rotary Discs Reactor (RDR) in order to produce higher yield of microbial cellulose. Furthermore, the pineapple juice from pineapple waste is low in acid and high glucose concentration is a potential as a substrate for fermentation process to produce microbial cellulose.

The optimum culture condition of RDR was culture medium with 20% (v/v) of waste pineapple concentrations. The production yield of microbial cellulose at this concentration was highest with the total weight of 255.85 g/L. The culture medium contains yeast extract 15.0g, bactopeptone 2.0g, ammonium sulfate ($(NH_4)_2SO_4$) 2.0g, sucrose 10g, potassium dihydrogen phosphate (KH_2PO_4) 1.5g, magnesium sulphate ($MgSO_4$) 0.25g and distilled water 800mL in 1L culture medium. The highest yield of microbial cellulose produced in RDR was 255.8452 g/L which was 31.02% more yield than shaken culture with additional micro particles after optimization process and 94.66 % more yield when compare the result obtained from RDR with static culture to produce microbial cellulose from pineapple waste as a substrate. Furthermore, this research only 1% (w/v) of sucrose used in order to produce microbial cellulose which obtained highest value of microbial cellulose at 20% (v/v) of waste pineapple which is 255.8452 g/L.

Therefore, pineapple waste is a good substrate to produce microbial cellulose because can reduce or eliminate other carbon source such as sucrose that will reduce the cost of chemical substance in industries. As a result with the use of RDR and waste pineapple as a substrate to produce microbial cellulose it will enhance the production rate of microbial cellulose and reduce the cost of substrate for industries field to produce microbial cellulose in a large capacity.

REFERENCES

[1] Alina, K., Maria, K.,Aginiezka, W.K., Stanislaw, B., Emilia, K., Aleksander, M., and Andrej, P., "Molecular Basis of Biosynthesis Disappearance in Submerged Culture of *Acetobacter Xylinum*." Institute of Biotechnology and Antibiotics, Warszawa, Poland. Vol.52, No.3/2005, 691-698, (2005).

[2] Brown, Jr. R.M., "Microbial Cellulose: A new Resource for Wood, Paper, Textiles, Food and Specialty Products". University of Texas, Austin (1986).

[3] Budhiono, A., Rosidi, B., Taher, H., Iguchi, M., "Kinetics Aspects of Bacterial Cellulose Formation Nata-de-Coco Culture System." Carbohydrate Polymers, Vol.40, pp.137-143 (1999).

[4] Ch'ng. C.H and Ida I.M, "Evaluation and Optimization of Microbial Cellulose (NATA) Production using Pineapple Waste as Subtract." Thesis, Technology University of Malaysia (2007).

[5] Holmes, D., "Bacterial Cellulose". MEng Thesis, University of Canterbury Christchurch, New Zealand (2004).

[6] Keshk, S.M.A.S. and Sameshima, K., "Evaluation of Different Carbon Sources for Bacteria Cellulose Production." Article Journal Biotechnology, Vol.4 (6), pp.478-482 (2005).

[7] Norhayati P. and Ida I.M, "Rotary Discs Reactor (RDR) for Enhanced Production of Microbial Cellulose", MEng Thesis, Technology University of Malaysia (2009).

[8] Son, H.J., Heo,M.S., Kim, Y.G., Lee, S.J., "Optimization of Fermentation Conditions for Production of Bacterial Cellulose by a New Isolated *Acetobactor sp. A9* in Shaking Cultures." Miryang National University. (2001).

[9] Verschuren, P.G., Cardona, T.D. Robert Nout, M.J., DE Gooijer, K.D., and Den Huevel, J.V. "Location of Cellulose Production by *Acetobacter Xylinum* Astablished from Oxygen Profiles." Journal of Bioscience & Bioengineering Vol.89, No.5, 414-419. (2000).

Titania(TiO_2) Nanoribbons As A Photocatalyst to Remove Dye from Aqueous Solution

Edmand Andrew Bedurus, Marinah Mohd Ariffin and Mohd Hasmizam Razali
Department of Chemical Sciences, Faculty of Science and Technology,
Universiti Malaysia Terengganu, 21030 Kuala Terengganu, Terengganu.
edmand_andrew@yahoo.com, erin@umt.edu.my, mdhasmizam@umt.edu.my

Abstract
In the present research, titania(TiO_2) nanoribbons was successfully synthesized by microwave assisted synthesis (MAS) method at an optimum condition (180 ^oC, 4h). High purity of anatase crystalline phase of TiO_2 nanoribbons were formed after 750^oC calcination in furnace (supported by XRD result). Due to anatase crystalline phase and smaller crystallite size, TiO_2 nanoribbons photocatalyst have successfully enhanced the removal rate of Rhodamine B dye in aqueous solution up to 99.13% within 2h.

Keywords
Titania(TiO_2) nanoribbons, microwave assisted synthesis (MAS) method, Rhodamine B, photocatalyst

INTRODUCTION

Dye wastewater generated from textile dye and printing industries has contributed to environmental pollution [1]. Rhodamine B, one of the most common applied xanthene dyes, is popular for its good stability as dye laser material and has become a common organic pollutant in dye wastewater [2]. Removal of color from wastewater generated by these industries is the great challenge of the world. Typical physical and chemical treatment method such as flocculation, adsorption, coagulation and activated sludge process have not completely removed this class of xenobiotics [3-4]. Yet, the most applied treatment for dye wastewater is the biological treatment method, which is not efficient in removing dyes. Therefore, dyes always remain unchanged chemically in the effluent of wastewater treatment plants, whereby can cause contamination of potable water and become concentrated in the sludge leading to disposal problem [1].

Thus, heterogeneous photocatalysis has been the subject of numerous investigations as it is an attractive technique for the complete destruction of undesirable contaminants, especially organic dyes in both the liquid and gaseous phase by using solar or artificial light illumination. Among all heterogeneous photocatalyst, titania(TiO_2) has been the most practical photocatalyst of choice for a variety of reactions due to its high chemical stability, low cost and non toxic in nature [5]. However, this unique property is highly dependent upon the crystallinity, morphology, and particle size of the photocatalyst.

In this study, microwave assisted thermal method was applied to synthesized the TiO_2 nanoribbons due to its short reaction time compared to other methods, including hydrothermal [5-8], sol-gel [9], and soft chemical process [10]. The mixture of commercial TiO_2 powder and 10 M NaOH aqueous solution was heated rapidly and more uniformly through direct molecular interaction with electromagnetic radiation (absorption of microwaves which were transformed into heat) [8].

Photocatalytic performance of the TiO_2 nanoribbons was examined for degradation of Rhodamine B in aqueous solution, and compared with commercial TiO_2.

METHODOLOGY

Synthesis of Titania(TiO_2) Nanoribbons

The titania(TiO_2) nanoribbons were synthesized *via* microwave-assisted synthesis (MAS) method. In typical preparation, 1 g of commercial TiO_2 powder (SIGMA) was suspended in 50 ml of 10 M NaOH aqueous solution [6]. This suspension was ultrasonicated for 30 min at 40 ^oC and the mixture was reacted in a microwave reactor (Milestone Microwave Laboratory Systems) with various heating time ranged from 2 hours to 6 hours at constant temperature (180 ^oC). After that, each sample was washed with 0.1 M HCl solution for an hour, followed by distilled water until pH value became nearly 7. Then, the washed white solid was filtered and dried at 60 ^oC overnight. After synthesization, each dried sample was calcined in furnace at 750 ^oC for an hour in order to remove impurities as well as to crystallize the nanoribbons. The optimum heating duration of MAS method was verified based on synthesized photocatalyst performance upon Rhodamine B decolorization.

Characterization

Morphology and elemental composition of commercial and synthesized TiO_2 powder was examined using scanning electron microscope (SEM, JEOL JSM-6360 LA). An X-ray diffractometer (XRD, Rigaku Miniflex II) with Cu Kα radiation (λ=0.15418 nm) was applied to

characterize the crystalline phase of the samples. The samples were spreaded on a glass slide specimen holder and the scattered intensity is measured between 20° and 80° at a scanning rate of 2θ = 5°/min.

Removal of Rhodamine B dye

In this study, Rhodamine B dye was applied as target sample. The removal or photodegradation was carried out inside a homemade photoreactor. Mixture of 100 ml of 10 mg/L dye solution and 0.1 g synthesized TiO_2 powder was stirred for 10 min in the dark condition so that an adsorption-desorption equilibrium could be established between dye-catalyst surface [2, 8]. Then, the mixture solution was irradiated with UV light (302 nm, 15 watt). During the illumination, 5 ml sample solution was withdrawn of the suspension at fixed intervals (30 min) and filtered to separate the catalyst particles. Each collected sample solution was analyzed via UV-Vis spectrophotometer (UV-1601PC, Shimadzu). The same photocatalytic procedure was applied on commercial TiO_2 powder (SIGMA) for comparison.

RESULTS AND DISCUSSION

Characterization

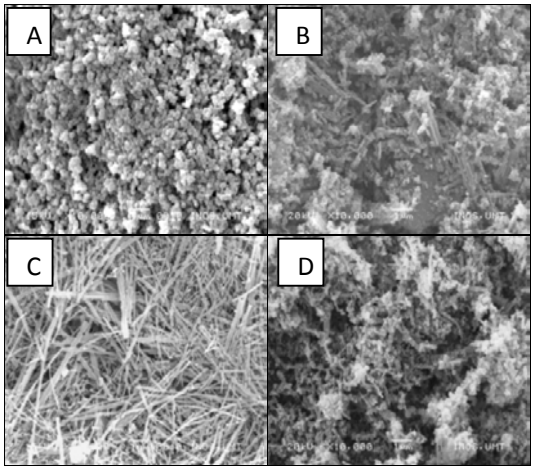


Figure 1: SEM images of (A) titania(TiO_2) commercial (precursor), and treated TiO_2 by MAS method at 180 °C for (B) 2h, (C) 4h, and (D) 6h which were calcined at 750 °C for 1h respectively

Fig. 1 shows the morphological structure of synthesized titania(TiO_2) photocatalyst at various heating time of MAS method ranged from 2 hours to 6 hours with constant heating temperature of 180°C. The images were observed in order to understand the morphology of TiO_2 nanoribbons. Micrograph of commercial TiO_2 powder was compared. The synthesized TiO_2 nanoribbons were developed almost homogeneously from beads shape of the precursor after heated through MAS process at 180°C for 4 hours. This optimum heating time is crucial to initiate sufficient driving force for nanoribbons formation.

At 2 hours of heating time, the nanoribbons formation was incomplete and some un-reacted particles were discovered due to insufficient driving force to accelerate the formation of nanoribbons. Meanwhile, at 6 hours heating time, nanoribbons were developed. However, the nanoribbons collapsed after undergo calcinations process. This is due to the thermodynamically unstable of the synthesized TiO_2 nanoribbons.

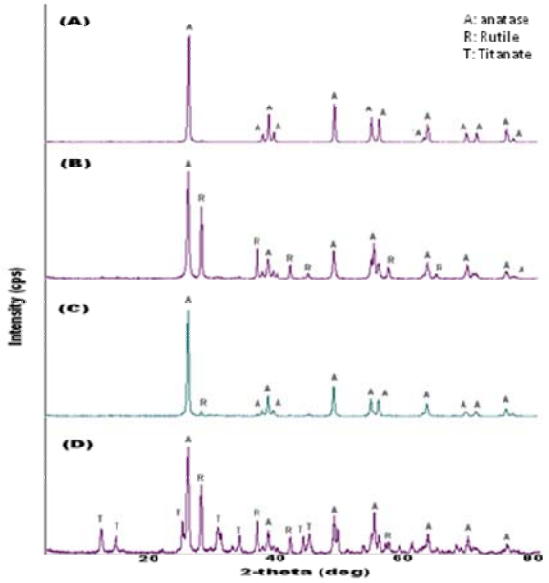


Figure 2: XRD patterns of (A) titania(TiO_2) commercial (precursor), and treated TiO_2 by MAS method at 180°C for (B) 2h, (C) 4h, and (D) 6h which were calcined at 750°C for 1h respectively

The XRD result indicates that the commercial TiO_2 powder (SIGMA) consists of anatase crystalline phase (sharp peaks). Treatment of microwave reactor had facilitated the reduction of peak intensities of anatase phase due to the formation of new peaks corresponding to amorphous structure. After calcination, the amorphous characteristic of all synthesized photocatalysts has been recrystallized back. Previous studies have proved that anatase crystalline phase possess the highest photocatalytic efficiency rather than other phases [8, 11].

From Fig. 2, it is obvious that only synthesized TiO_2 at 180°C for 4 hours of MAS method with calcination temperature 750°C had showed the highest anatase crystalline phase. XRD pattern of synthesized TiO_2 at 2 hours of heating time showed the mixture of anatase and rutile crystalline phase

while at 6 hours of heating time, mixture of anatase, rutile and some sodium titanate were recorded. Average crystallite size of all the synthesized TiO_2 was calculated using Sherrer equation:

$$d = \frac{K\lambda}{\beta \cos\theta}$$

where d is the average crystallite size (nm), λ is the wavelength of Cu Kα radiation applied (λ = 0.154), θ the is the Bragg's angle of diffraction, β is the full-width at half maximum intensity (FWHM) of observation at 2θ = 25.6° (converted to radian) and *K* is the constant (usually applied as ~0.94). From the calculation, the average crystallite size of TiO_2 nanoribbons is ~34.70 nm while the commercial TiO_2 is ~46.59 nm. Usually, decreasing in the average crystallite size of TiO_2 may cause the surface area become larger. Therefore, the surface area of TiO_2 nanoribbons is relatively larger than its raw material. Since the photocatalytic degradation of dye mainly occurs on the surface of the photocatalyst, therefore it may increase the photocatalyst performance.

Removal of Rhodamine B dye

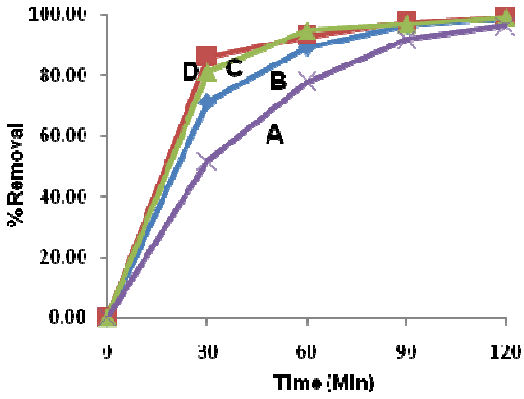


Figure 3: Percentage of photodegradation of Rhodamine B dye in the presence of (A) TiO_2 commercial, and treated titania (TiO_2) by MAS method at 180°C for (B) 2h, (C) 6h , and (D) 4h respectively

In order to verify the performance of synthesized titania photocatalyst, 10 ppm of Rhodamine B was utilized as target sample. Fig. 3 shows the graph percentage of degradation of Rhodamine B versus illumination time of UV light in presence of (A) commercial titania(TiO_2), and synthesized TiO_2 for (B) 2 hours, (C) 6 hours and (D) 4 hours with calcination for an hour at 750°C respectively. Prior to UV light illumination, the photocatalysis system was placed in the dark for 10 minutes so that the adsorption saturation of Rhodamine B on the photocatalyst could occur. This step could distinguish the discoloration of Rhodamine B between absorption-desorption equilibrium and photocatalysis activity on the photocatalyst [2, 8].

The photocatalytic activity is evaluated by following equation [12]:

$$Percentage\ of\ degradation = \frac{C_o - C}{C_o} \times 100\%$$

where Co represent the concentration at the adsorption-desorption equilibrium and C is the concentration at irradiation time *t*. From Fig. 3, the highest photodegradation rate of Rhodamine B was catalyzed by synthesized TiO_2 at 180°C for 4 hours heating time of MAS method which was up to 99.13% within 2h of UV light illumination. This result is parallel with the XRD pattern whereby the anatase crystalline phase may increase the performance of the photocatalyst. Due to smaller crystallite size, the performance of TiO_2 nanoribbons is higher compared to the commercial TiO_2 although both are consist of high anatase crystalline phase. Some of the characteristics and photocatalytic performance towards Rhodamine B dye removal by commercial and synthesized TiO_2 have been simplified in Table 1.

Table 1: Properties and performance of commercial and synthesized TiO_2 photocatalyst

Photocatalyst	Ribbons-like structure	Crystalline phase	Average crystallite Size	% of dye removal after 2h
TiO_2 (MAS 2h)	X	Anatase Rutile	36.18 nm	98.79%
TiO_2 (MAS 4h)	/	Anatase	34.70 nm	99.13%
TiO_2 (MAS 6h)	**X**	Anatase Rutile Titanate	30.44 nm	98.87%
TiO_2 (Commercial)	**Sphere-like structure**	Anatase	46.59 nm	96.20%

CONCLUSION

In this study, nanoribbons structure with high anatase crystalline phase has been successfully synthesized *via* microwave assisted synthesis (MAS) method at 180°C for 4 hours followed by calcination process at 750°C for an hour. The result of removal upon 10 ppm Rhodamine B dye showed that the highest rate of photocatalytic activity was recorded by the synthesized titania(TiO_2) nanoribbons which is up to 99.13% within 2 hours.

ACKNOWLEDGEMENT

This research was supported by Fundamental Research Grant Scheme (FRGS), vote 59121 and Science Fund, vote 52027 funded by Ministry of Higher Education (MOHE) and Ministry of Science, Technology and Innovation (MOSTI) of Malaysia

Government respectively. Special thanks to Institute of Oceanography (INOS) and Department of Physical Sciences of UMT for the permission of SEM and XRD application, respectively.

REFERENCES

[1] Carneiro, P. A., Umbuzeiro, G. A., Oliveira, D. P., Zanoni, M. V. B. 2010. Assessment of water contamination caused by a mutagenic textile effluent/dyehouse effluent bearing disperse dyes. Journal of Hazardous Materials. 174: 694-699.

[2] Asiltürk, M., Sayılkan, F., Erdemoğlu, S., Akarsu, M., Sayılkan, H., Erdemoğlu, M., Arpaç, E. 2006. Characterization of the hydrothermally synthesized nano-TiO2 crystallite and the photocatalytic degradation of Rhodamine B. Journal of Hazardous Materials. B129: 164-170.

[3] Lane, T. J., Baruth, E. E. 2005. The Challenge of Water Treatment Plants Design. In Water Treatment Plant Design, 4th edition. McGraw-Hill Inc. New York. 1.1 p - 1.5 p.

[4] Hou, Y., Li, X., Liu, P., Zou, X., Chen, G., Yue, P.-L. 2009. Fabrication and photo-electrocatalytic properties of highly oriented titania nanotube arrays with {101} crystal face. Separation and Purification Technology. 67: 135-140.

[5] Sharma, S. D., Saini, K. K., Kant, C., Sharma, C. P., Jain, S. C. 2008. Photodegradation of dye pollutant under UV light by nano-catalyst doped titania thin films. Applied catalysis B: Environmental. 84: 233-240.

[6] Zhenhua, L., Zhongqing, L., Qingzhi, Y., Yichao, W., Changchun, G. 2008. Preparation and performance of titanate nanotube by hydrothermal treatment. Rare Metals 27 (2): p. 187.

[7] Zhang, Y. X., Li, G. H., Jin, Y. X., Zhang, Y., Zhang, J., Zhang, L. D. 2002. Hydrothermal synthesis and photoluminescence of TiO2 nanowires. Chemical Physics Letters. 365: 300-304.

[8] Ribbens, S., Meynen, V., Tendeloo, G. V., Ke, X., Mertens, M., Maes, B. U. W., Cool, P., Vansant, E. F. 2008. Development of photocatalytic efficient Ti-based nanotubes and nanoribbons by conventional and microwave assisted synthesis strategies. Microporous and Mesoporous Materials 114: 401-409.

[9] Kasuga, T., Hiramatsu, M., Hoson, A., Sekino, T., Niihara, K. 1998. Formation of titanium oxide nanotube. Langmuir. 14: 3160-3163.

[10] Qian, L., Du, Z.-L., Yang, S.-Y., Jin, Z.-S. 2005. Raman study of titania nanotube by soft chemical process. Journal of Molecular Structure. 749: 103-107.

[11] Oh, H.-J., Lee, J.-H., Kim, Y.-J., Suh, S.-J., Lee, J.-H., Chi, C.-S. 2008. Synthesis of effective titania nanotubes for wastewater purification. Applied Catalysis B: Environmental 84: 142-147.

[12] Razali, M. H., Dris, M. R. M., Rudin, N. N. S. M. 2009. Photodegradation of methyl orange dye using titanium dioxide photocatalyst. Journal of Sustainability Science and Management 4(1): 49-55.

Production and Characterization of Potentially Thermostable Protease from *Bacillus* Species Isolated from Terengganu

Mohd Zairi Salleh *, Noor Azlina Ibrahim
Faculty of Agro Industry and Natural Resources, University Malaysia Kelantan, 16100 Pengkalan Chepa, Kota Bharu, Kelantan.
Corresponding author: mohd_zairi1982@yahoo.com

Abstract
Screening and isolation of proteolytic bacteria were carried out from water and soil samples of hot spring area at Besut (Northern part of Terengganu). Two isolates were positive on skim milk agar (SMA) and identified as Bacillus subtilis A1 and Bacillus licheniformis A2 through morphological, biochemical and 16S rDNA gene identification. These two isolates have been selected for further study. The activity of crude protease of both isolates were assayed based on the effect of inhibitors, pH and temperature. Inhibitor ethylenediamine tetraacetic acid (EDTA) shows the successful inhibitor for protease activity of both species with 90% inhibition and thus strongly proved that this enzyme belongs to the metalloprotease family. Maximum enzyme activity was observed between 37°C and 65°C and pH 5 to 10. From the results showed that protease of both Bacillus species have optimum temperature at 60°C and clearly classified as alkaline protease. This also indicates that protease produce would be thermostable.

Keywords
Protease, proteolytic bacteria, *Bacillus subtilis, Bacillus licheniformis*..

INTRODUCTION

Serine protease (EC. 3.4.21). cystein protease (EC.3.4.22), aspartic protease (EC.3.4.23) and metallo-protease (EC.3.4.24) constitute one of the most important groups of industrial enzymes accounting for about 60% of the total worldwide enzyme sale [12]. Among the various proteases, bacterial proteases are the most significant, compared with animal and fungal proteases. And among bacteria, Bacillus species are specific producers of extracellular proteases [4]. These proteases have wide applications in pharmaceutical, leather, laundry, food and waste processing industries [13]. Different Bacillus species were known for their ability to produce thermostable protease that have an optimum activity more than 85-90ºC [6, 10]. The demand on thermostable protease increases due to its important in some applications. Thermostable proteases are advantageous in some applications because higher processing temperature can be employed, resulting in faster reaction rates, increase in solubility of nongaseous reactants and products, and reduced incidence of microbial contamination by mesophilic organisms. Thermophilic bacteria from hot springs produced unique thermostable enzymes [15]. In this study, the isolates have been enriched on skim milk agar (SMA) for protease production and then later identified by morphological, physiological and 16S rDNA gene sequence analysis. Protease production by *Bacillus subtilis* A1 and *Bacillus licheniformis* A2 were analysed based on the effect of the inhibitors, pH and temperature on their activity.

MATERIALS & METHODS

Isolation and identification

Soil and water samples were taken from the point of outflow of the La hot spring, Besut, Terengganu for preparation of initial cultures. The pure isolated bacteria were identified based on cellular morphology, biochemical and 16S rDNA gene.

Screening of protease production

The identified bacteria were plated on skim milk agar (SMA) and incubated at 50ºC for 24 hours. A clear zone of skim hydrolysis gave an indication of protease producing organisms.

Preparation of crude enzyme

10 ml of 24 hours culture was harvested by spinning at 10,000 rpm for 10 mins at 4 ºC. The supernatant was collected and filtered with cellulose acetate membrane (pore size 0.22 µm).

Determination of protease activity

Protease activity was determined in triplicate by incubating 0.5% azocasein in Tris-HCL buffer with crude enzyme solution. The reaction was stopped with 15% Trichloroacetic acid (TCA) and supernatant from centrifugation of the mixture was read at 450 nm. One unit (U) of protease activity was defined as micromole of substrate converted per minute under standard assay conditions.

Effect of inhibitors on protease activity

The protease activity was measured in the presence of different classes of inhibitors. 2.5 mM PMSF, 2.5 mM iodoacetate acid (IAA), 2.5 mM EDTA), 2.5 mM pepstain, 1 mM bestatin) were mixed with the protease enzyme in 1:1 ratio and incubated at room temperature for 30 minutes. The mixture (100 ul) was assayed for the residual protease activity by using

azocasein (0.8% w/v dissolved in 0.1 mM Tris-HCl-2 mM $CaCl_2$, pH 9.0) as substrate. PMSF and IAA were dissolved in dimethylformamide, bestatin and pepstatin were dissolved in methanol, and EDTA in water. Tris-HCl, pH 9.0 (10 mM) buffer was used as the control.

Effect of pH on protease activity

The effect of pH on protease activity from both isolates was determined by incubating the crude protease with different pH together 0.5% azocasein. Phosphate buffer (pH 5 and 6), Tris-HCl buffer (pH 7 and 8) and glycine-NaOH buffer (pH 9 – 10) were prepared. The enzyme mixture at different pH was incubated at 37°C for 24 hrs. Protease activity was measured through assay of protease activity.

Effect of temperature on ptorease activity

In order to determine the effect of temperature on proteolytic activity, 1 ml of 0.5% azocasein and 0.1 ml crude enzyme was incubated at 37°C, 40°C, 45°C, 50°C, 55°C, 60°C and 65°C [4]. Then, the protease activity was measured through assay of protease activity. Control samples were assayed by adding the enzyme at the end of incubation period after the additional of TCA.

RESULTS & DISCUSSION

Two isolates have been identified as protease producers and through gram staining both isolates were derived from *Bacillus* sp. based on their morphology and biochemical test. Both isolates have been identified as *Bacillus subtilis* A1 and *Bacillus licheniformis* A2 through 16S rDNA gene identification. According to Watanabe and Hayano (1993) identified *B. subtilis, B. licheniformis, B. cereus and megaterium* in soil isolation whereas Folasade and Joshua (2005) had identified *B. brevis, B. licheniformis, B. subtilis, B. macerans, B. mycoides, B. coagulans, B. polymyxa, B. cereus and B. megaterium* in soil isolation from warm spring. In another study, Waksman (1961) identified 29 isolates as *B. megaterium* and 24 isolates as *B. subtilis* out of 306 soil samples. These agree with the result of this study that *Bacillus* genera are widespread among bacteria in soil.

Protease activity was determined in triplicate by incubating 0.5% azocasein in Tris-HCL buffer and was found that *Bacillus licheniformis* A2 exhibits 9% higher activity of protease than *Bacillus subtilis* A1 and this also agree with the study of Folasade and Joshua (2005). Several inhibitors were used to study the characteristics of protease produced by both isolates. Figure 2 shows that EDTA is identified as a strong inhibitor for protease produced from these two isolates. 99.3% inhibition was shown for *Bacillus licheniformis* A2 and 99.4% inhibition for *Bacillus subtilis* A1.

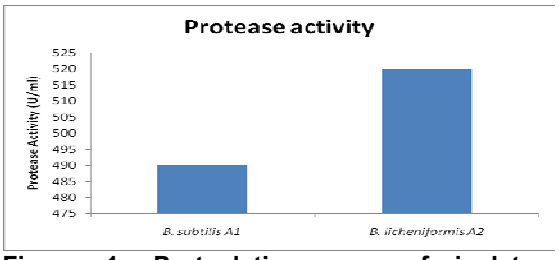


Figure 1: Proteolytic assay of isolates *Bacillus subtilis* A1 and *Bacillus licheniformis* A2.

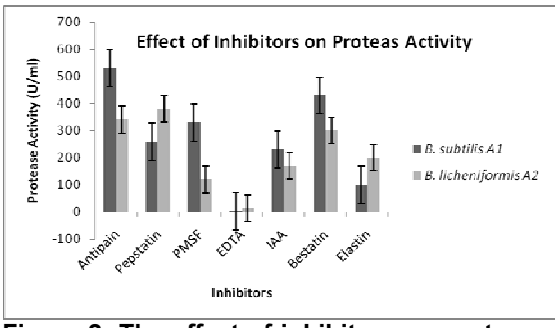


Figure 2: The effect of inhibitors on protease activity of *B. subtilis* A1 *and B. licheniformis* A2.

Inhibitors of sulfhadryl protease, indoacetamide (IAA); aspartic protease, pepstatin; aminopeptidase, bestatin; and serine protease, phnylmethylsulfonylfluoride (PMSF) and elastin did not inhibit the protease activity. However, the protease activity of *Bacillus subtilis* A1 and *Bacillus licheniformis* A2 was inhibited by the metalloprotease inhibitor, ethylenediamine tetraacetic acid (EDTA), which resulted more than 90% inhibition. The results clearly indicate that this enzyme belongs to the metalloprotease family [14].

As it is seen from the activity profile (Figure 3**)** at different pH**,** *B. licheniformis* A2 has a much broader pH range than *B. subtilis* A1. From the graph, maximum protease activity was observed at pH 8 for *B. subtilis* A1 and pH 9 for *B. licheniformis* A2. It can be concluded that both isolates are alkaline protease producers.

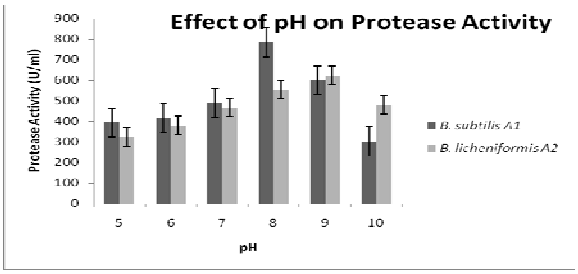


Figure 3: Protease activity from *B. subtilis* A1 and *B. licheniformis* A2 at different pH.

Based on the effect of temperature on proteolytic activity at range of 37 - 65°C,results that protease produced from both *Bacillus* strains have almost the same pattern of temperature changes. 60°C shows the optimum temperature for the activity of protease of both strains. Therefore it can be concluded that *B. subtilis* A1 and *B. licheniformis* A2 are thermophiles and these might be sources of thermostable protease.

Many studies have been done in identification and isolation of thermophilic bacteria for the production of protease since it could find application in industry and biotechnology. For example isolation of thermophilic bacteria in Thai hot spring (Thailand) which were reported to produce thermostable proteases [16]. Thus, this study might be an indication that *B. subtilis* A1 and *B. licheniformis* A2 would produce thermostable alkaline protease and will further study for cloning and protease purification.

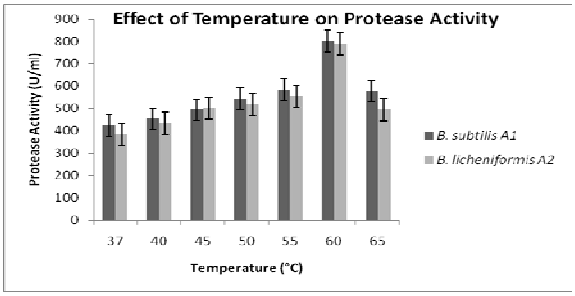


Figure 4: Protease activity from *B. subtilis* A1 and *B. licheniformis* A2 at different temperature.

ACKNOWLEDGEMENT

A great thankful to Faculty of Agro Industry and Natural Resources (FASA) as providing space and support for this study to be progressed and also my supervisor Dr. Noor Azlina for advice and help. This research was supported by Fundamental Research Grant Scheme (FRGS).

REFERENCES

[1] Adams, M. and R. Kelly, 1998. *Finding and using hyperthermophilic enzymes*. Trends in Biotechnol., 16:329-332.

[2] Chai, I. G., Borg, W. G., Kim, S. H. and Yu, Y. G. 1999. *Extremely thermostable serine-type protease from the Aquifex pyrophilus*. Journal of Biological Chemistry. 274:881-888.

[3] Clouse R., Janies D. and Kerr A. M. 2005. *Resurrection of Bohadschia bivittata from B. marmorata (Holothuroidea: Holothuriidae) based on behavioral, morphological and mitochondrial DNA evidence*. Zoologicsl 108: 27-39.

[4] Folasade M., Olajuyigbe and Joshua O. A. 2005. *Production of dynamics of extracellular protease from Bacillus species.* African Journal of Biotecnology. Vol. 4(8): 776-779.

[5] Fu, Z., Hamid, S. A., Razak, C. N. A., Basri, M., Saleh, A. B. And Rahman, R. N. Z. A., 2003. *Secretory expression and purification of a heat-stable alkaline protease.* Protein expression and purification. 28:63-68.

[6] Fujiwara, N., A. Masui and T. Imanaka, 1993. *Purification and properties of the highly thermostable alkaline protease from an alkaliphilic and thermophilic Bacillus sp.* J Biotechnol., 30:245-256.

[7] Gupta, R., Beg, Q. K. and Lorenz, P. 2002. *Bacterial alkaline proteases: molecular approaches and industrial applications*. Applied microbiolgy and biotechnology. 58:15-32.

[8] Kamarul R.K., Ridzwan H. and Gires U. 2010. *Phylogeny of sea cucumber (Echinodermata: Holothuroidea) as inferred from 16S mitochondrial rRNA gene sequence*. Sains Malaysiana.

[9] Kwon, Y. T., Kim, J. O. Moon, S. Y., Yoo, Y. O. and Rho H. M. 1995. *Cloning and characterization of the gene encoding extracellular alkaline serine protease from vibrio metschnikovii strain RH530*. Gene. 152:59-63.

[10] Lee, J. K., Y. O. Kim, H. K. Kim, Y. S. Park and T. K. Oh, 1996. *Purification and characterization of a thermophilic alkaline protease from thermoactinomyces sp. E79 and the DNA sequence of the encoding gene*. Biosci Biotechnol Biochem, 60:840-846.

[11] Mignard S. and Flandrois J. P. 2006. *16S rDNA sequencing in routine bacterial identification: A 30-month experiment*. Journal of Microbial Methods.

[12] Nascimento W. C. A. and Martin M. L. L. 2004. *Production and properties of an extracelluar protease from thermophilic Bacillus sp*. Braz. J. Microbiol. 35:1-2.

[13] Pastor M. D., Lorda G. S. and Balatti A. 2001. *Protease obtention using Bacillus subtilis 3411 and amaranth seed meal medium at different aeration rates.* Braz. J. Microbiol., pp. 32: 1-8.

[14] Rahman, R. N. Z. A., Razak, C. N., Ampon, K., Basri, M., Yunus, W. M. Z. W., Salleh, A. B. 1994. *Purification and characterization of a heat-stable alkaline protease from Bacillus stearothermophilus F1*. Applied Microbiology and Biotechnology 40:822-827.

[15] Rao B. M., Tanksale M. A., Ghatge S. M., Deshpande V. V. 1998. *Molecular and Biotechnological Aspects of Microbial Proteases*. Microbiol. and Mol. Biol. Rev. 62 (3): 597-635.

[16] Sookkheo B., Sinchaikul S., Phutrakul S. and Chen S. T. 2000. *Purification and characterization of the highly thermostable proteases from Bacillus stearothermophilus TLS33, protein expression and purification.* 20: 142-151.

[17] Waksman S. A. 1961. *Microbial* Rutgers Univ. Copyright, 3rd print.

[18] Woose, C. R., W. G. Weisburg, B. J. Paster, C. M. Hahn, R. S. Tanner, N. R. Krieg, H. P. Koops, H. Harms, and E. Stackebrandt, 1998. *The phylogeny of purple bacteria: the beta subdivision*. Syst. Appl. Microbiol. **5:**327-336.

Effect of Light Intensity, Temperature and Diet on Reproduction of *Hirudinea* sp.

Zulhisyam Bin Abdul Kari*, Ahmad Anwar Ismail and Ibrahim Che Omar
Faculty of Agro Industry and Natural Resources,
Universiti Malaysia Kelantan, Pengkalan Chepa, 16100, Kota Bharu, Kelantan.
Tel: +6013-9115161. E-mail: mrzulhisyam@yahoo.com

Abstract
Leeches (Phylum: Annelida, Class: Hirudinea) are widely distributed all over the world in various habitats, such as freshwater, seas, desert, and oases [1]. *In this study, the effect of light intensity, temperature and diet on the reproductive efficiency of Hirudinea sp. was examined with eight different conditions with condition 1 (temperature: 25-28°C, light intensity: 0 lx, diet: fresh eel blood), condition 2 (temperature: 30-32°C, light intensity: 0 lx, diet: fresh eel blood), condition 3 (temperature: 30-32°C, light intensity: 100-150 lx, diet: fresh eel blood), condition 4 (temperature: 25-28°C, light intensity: 100-150 lx, diet: fresh eel blood), condition 5 (temperature: 30-32°C, light intensity: 100-150 lx, diet: booster), condition 6 (temperature: 25-28°C, light intensity: 100-150 lx, diet: booster), condition 7 (temperature: 25-28°C, light intensity: 0 lx, diet: booster) and condition 8 (temperature: 30-32°C, light intensity: 0 lx, diet: booster). After 3 months of culture, the number of cocoons produced was very significantly different among the different conditions (p=0.00). The average number of hatchlings per cocoon was significantly different ($p \leq 0.05$) where condition 1 gave the highest number with mean and standard deviation of 6.23±0.25, but hatching rate was not (p=0.354). The condition 5 produced the highest mortality of parent leeches with mean and standard deviation of 52±13.86%. The size of the cocoons were not significantly different among the treatments, with the condition 1 having the largest cocoon size with the means and standard deviations of 22.19±0.92mm and 13.26±0.07mm according to their length and diameter, respectively. The wet weight of cocoons was significantly different ($p \leq 0.05$) with the condition 1 producing the heaviest with the mean and standard deviation of 1.26±0.11g compared to condition 5 the lightest with mean and standard deviation of 0.22±0.38g.*

Keywords
Hirudinea sp., temperature, light intensity, survivorship, reproduction, growth

INTRODUCTION

Leeches are distributed all over the world in a variety of habitats; in freshwaters, seas, deserts, and oases. They are important components in food chains; as predators, vectors of parasites, preys of aquatic animals [2]. They occur in habitats that range from terrestrial to aquatic (both marine and freshwater) environments and are found on all continents. Leech was used by toxicologists and pharmacologists as a convenient tool for various investigations [2, 3, 4] in the past when its natural resources were boundless. In recent years, some leech populations have declined dramatically due to over-exploitation for fishing bait and medicinal purposes (particularly in Europe and Asia), and due to pollution [5, 6, 7, 8, 9]

Hirudinea sp. is a sanguivorous (haemopagic), freshwater leech, with a wide distribution in Southeast Asia, such as in southern China, the Philippines, Thailand, Vietnam and Malaysia. In Malaysia, these leeches are known as 'Lintah Kerbau' [10]. Traditionally, leeches are widely used as a model animal in toxicological, physiological, neurobiological, biochemical, histological and many other studies [2, 3, 11, 12, 13, 14, 15]. There has been an increasing harvest of this species for medical purposes in the 20th century [18, 19, 20] and so is in Malaysia. In this country, it is not known or proven conclusively that the locally named Buffalo Leech is not of *H. manillensis*. Local taxonomists have not been able to identify the species used those for medical purposes and would rather refer to its genus only as *Hirudinea* sp.

During the reproductive process, parent leeches secrete cocoons that protect and often nurture the developing eggs during the critical stages of early development [21, 22]. Components of the cocoons are released from specialized glands situated within the clitellar sex segments, forming a sheath around the clitellum into which fertilized eggs are deposited. The cocoon membrane is then passed over the head and sealed at both ends forming "plugs" at either end [23]. Embryos are dependent upon cocoon fluid contained in hard-shelled cocoons, while embryos from membranous cocoons can develop independently of the cocoon [24].

The breeding of leeches for medical purposes has bright commercial potential and of late many entrepreneurs have embarked on the farming of leeches. In order to meet the demand from clinical use, Chinese traditional medicine and other scientific research, there has been growing interest in culturing and breeding leeches in many countries [22, 9]. The factors which determine leech distribution in

freshwater environments are, in approximate order of significance, availability of food organisms; nature of the substrate; depth of water; presence of water currents; size and nature of the body of water; hardness and pH; temperature of the water; dissolved oxygen; siltation and turbidity; and salinity [2]. However, there was no proper study carried out on the factors affecting growth and production of leeches in the country. Particularly lacking is the effect of water, temperature, dissolved oxygen, pH, and light intensity on growth conditions of these leeches bred in a farm as well as the feeding requirements. The aim of the present study is to test the effects of different temperatures, light intensities and diet on the reproductive performance of this leech species.

MATERIAL AND METHODS

Sample preparation

Hirudinea sp. (Buffalo Leech) used in the study was provided by PT Dynamic Consultant Co., Kota Bharu, Kelantan. The leeches were cultured in concrete tanks (20 ×10 × 20 m) filled with non-chlorine water source which were from river, well and rain to a depth of 25 cm. The concrete tanks were divided to four compartments. Approximately 1000 leeches were cultured in every compartment. The water in the concrete tanks was not aerated and exposed to direct sun light. Water hyacinth was placed in the concrete tanks and the leeches were fed once on live eel blood every week and once with an artificial booster every month. Sand was placed in the concrete tank to a height of 12 cm. Before the start of the experiment, leeches were cultured for 1 week in an indoor aquarium filled with non-chlorine freshwater (30cm depth, 600L),aerated and 50% of the water changed once every 3 days. The temperature, pH and light intensity were maintained at 27.92 ± 6.62 °C, 6.8 ± 0.3 and 1000-1500 lx, respectively. The leech was fed once on live eel blood and once with an artificial booster in the preceding week before the proper study was initiated.

Experimental design

Eight treatment combinations were used to test the effect of growth conditions on breeding densities and reproductive efficiency. For each of the three factors, two levels were imposed, low and high as presented in Table 1.

Treatments	Feeding		Light Intensity (lx)		Temperature (°C)	
Condition/Level	FT 1	FT 2	Low	High	Low	High
C_1	Eel blood	-	0	-	25-28	-
C_2	Eel blood	-	0	-	-	30-32
C_3	Eel blood	-	-	100-150	-	30-32
C_4	Eel blood	-	-	100-150	25-28	-
C_5	-	Booster	-	100-150	-	30-32
C_6	-	Booster	-	100-150	25-28	-
C_7	-	Booster	0	-	25-28	-
C_8	-	Booster	0	-	-	30-32

Table 1: Different conditions tested on growth and reproductive efficiency of leeches.

Each treatment consisted of three replicates with a total of 24 aquarium tanks (30 x 19 x 26 cm) with 25 leeches in each replicate tanks. Approximately 600 leeches were collected from the holding tank, and randomly placed into the assigned experimental aquariums. Soil to about 25 cm depth was provided as substrate in each aquarium. The leeches were fed once on live eel blood every week and once with an artificial booster every month during the study period from January 1, 2010 to March 12, 2010. Over the three months period, daily observations were made.

Experimental methods

Cocoon deposition number

At the end of the experiment, all the cocoons deposited by the broodstock were collected and counted and the average deposition number of cocoons for each growth condition was calculated.

Hatching number and hatching rate

After the juveniles were released from the cocoons, they were collected and counted. The ratio of the numbers of juveniles to deposited cocoons was calculated for each growth condition to obtain the average hatching number.

During the experiment, the abortion rate was high and the number of dead cocoons (juveniles failed to hatch) were counted and recorded. The ratio of dead to the deposited cocoons was then calculated as the average hatching rate for each treatment.

Broodstock mortality

The number of dead broodstock leeches was recorded during the daily observation.

Cocoon size and wet weight

All cocoons collected from each treatment were sampled randomly and their length and diameter measured. The wet weight of each cocoon was taken before hatching occurred.

Data analysis

Statistical analyses were conducted using the software SPSS 17.0 (Statistical Program for Social Sciences 17.0) to test the difference among the growth conditions and any differences obtained were considered significant at $p \leq 0.05$. The cocoon deposition number of broodstock leeches, hatching number and hatching rate of cocoon, survivorship of parent leeches, cocoon size and wet weight were analyzed by one-way ANOVA and where this effect was significant; Duncan test was performed to compare the treatments.

RESULTS

Cocoon deposition number

The number of cocoon deposited by the broodstock leeches was very significantly different among the

different densities (p=0.00). The average number of cocoons was highest in the C_1 with mean and standard deviation of 6±1, followed by C_2 with mean and standard deviation of 4±1. Both treatments differ significantly from the rest of the growth conditions of C_3, C_4, C_5, C_6, C_7 and C_8 which among themselves were not significantly different from one another (Table 3).

Hatching number

Hatching number was significantly different under different growth conditions ($p \leq 0.05$). The condition under C_1 had the highest hatching number with mean and standard deviation of 6.23±0.25 while under the C_3 conditions the lowest hatching number was obtained with mean and standard deviation of 0.5±0.87. Hatching numbers of the cocoons in the C_2, C_4, C_5, C_6, C_7 and C_8 did not differ significantly (Table 3).

Hatching rate

Hatching rates of cocoons under different conditions were not significantly different ($p \geq 0.05$). Although the C_1 treatment had the highest hatching rate with value of mean and standard deviation of 95.23±8.26% but this was not significantly different among the eight conditions tested (Table 3).

Mortality of broodstock leeches

Mortalities of broodstock leeches differed significantly under different growth conditions (p=0). The C_1 had the lowest mortality rate with mean and standard deviation of 2.67±2.31% compared with C_5 which gave the highest mortality rate of 52±13.86%. Mortality under other condition also showed a significant difference (Table 3).

Cocoon size

The different temperature, light intensity and diet did not significantly influence the standard length and diameter of the cocoons produced ($p \geq 0.05$, p=0.153). Cocoon standard length and diameter in the C_1 were the largest with mean and standard deviation of 22.19±0.92 mm and 13.26±0.07 mm, respectively, whereas the cocoon standard length and diameter in the C_5 treatment were the smallest with mean and standard deviation of 4.74 ± 8.22 mm and 3.34 ± 5.78 mm, respectively. There was no difference in cocoon standard length and diameter obtained those cultures in C_2, C_3, C_4, C_6, C_7, and C_8 growing conditions (Table 3).

Cocoon wet weight

The temperature, light intensity and diet imposed significantly influenced cocoon wet weight (p=0). Broodstock in the C_1 treatment produced the heavier cocoons with mean and standard deviation of 1.26 ± 0.11 g, whereas the C_5 treatment had the smallest cocoon wet weight with mean and standard deviation of 0.22 ± 0.38 g. Cocoon wet weight under the C_3, C_4, C_6, C_7 and C_8 regimes did not differ significantly (Table 3).

Table 3:Comparison of reproductive features of the Hirudinea sp. under different conditions: cocoon number, hatching number, hatching rate (%), mortality rate of parent leeches (%), cocoon standard length (mm), diameter (mm) and cocoon wet weight (g).

	Growing conditions							
Reproductive parameters	C1	C2	C3	C4	C5	C6	C7	C8
Cocoon number (p=0.00)	6±1a#	4±1b	0.67±1.16c	1.33±0.58c	0.67±1.16c	0.67±0.58c	2±1c	1.67±1.16c
Hatching number ($p \leq 0.05$)	6.23±0.25a	3.14±1.27b	0.5±0.87b	2.83±2.47b	2.17±0.29b	2.33±2.08b	1.67±1.53b	2±2b
Hatching rate (%) ($p \geq 0.05$)	95.23±8.26a	62.77±25.64ab	16.67±28.87b	70±51.96ab	80±26.46ab	66.67±57.74ab	72.33±25.42ab	74.33±36.14ab
Cocoon length (mm) ($p \geq 0.05$)	22.19±0.92a	19.27±0.19ab	5.58±9.67bc	16.6±0.39c	4.74±8.22c	9.48±8.21c	12.24±11.4c	9.41±8.15c
Cocoon diameter (mm) (p=0.153)	13.26±0.07a	11.49±0.13ab	3.39±5.87b	11.17±0.3ab	3.34±5.78b	6.7±5.8ab	7.68±6.79ab	6.75±5.85ab
Cocoon wet weight (g) ($p \leq 0.05$)	1.26±0.11a	1.05±0.01a	0.23±0.4b	1.13±0.07a	0.22±0.38b	0.51±0.44ab	0.76±0.67ab	0.67±0.58ab
Mortality rate (%) (p=0.00)	2.67±2.31a	13.33±2.31a	44±4d	33.3±2.3bc	52±13.86e	29.33±8.33b	37.33±2.31c	46.67±6.11de

#Data in the table were mean and standard deviation (mean ± S.D). Means with the same letter within the same column are not different at the 5% of significant level as determined by Duncan test.

DISCUSSION

Determining optimum condition is a key factor for successful leech culture and reproduction. For example, mortality of the leech *Hellobdella stagnalis* is influenced by broodstock density and the density of their offspring [25]. In this study, increasing temperature and light intensity had a negative effect on the number of cocoons that the broodstock produced. In general, under the condition where the temperature was 25-28°C with a light intensity of 0 lx and fed with a fresh eel blood cocoon deposition number was optimal depositing an average of 6 ± 1 cocoons per replicate. In the present study, it was found that each cocoon that was produced was laid on top of the soil (Fig.1). This number was lower within the range of that obtained with *Haemadispa hainana* (ranging from 4 to 8.15 cocoons deposited) [26], and that of *N. obscura*, (average of 8.33 ± 0.68 cocoons deposited) [27]. According to B. Zhang *et al*. [28], increasing broodstock density had a negative effect on the number of cocoons that the broodstock produced. In his study, a density of 5 leeches per tank was optimal for cocoon deposition, with each leech depositing an average of 3.84±0.12 cocoons where the temperature and light intensity were 25.92±6.61 and 1000-1500 lx, respectively. The differences in the cocoon deposition number obtained in that study from the present one is that from the former it was derived

from each leech in each treatment whilst in the latter study the number was based on 25 leeches per replicate treatment. B. Zhang *et al*., [28] stated that the low cocoon numbers of broodstock leeches under high density appeared to be related to competition for food and space among the leeches, creating a stressful condition which directly affects the natural reproductive behavior. However, in the present study, the broodstock density was similar throughout with 25 leeches per replicate under every treatment ruling out other factors except those that was imposed namely; temperature, light intensity and diet which had a direct effect to the number of cocoons produced.

Figure 1. Individual cocoon produced by an adult *Hirudinea* sp. laid on top of the soil

The duration of leech growth, development and reproduction can often be different due to different culture temperatures [26]. In the present study, the duration of reproduction was 102 days with a temperature range of 25-28 °C, which is within the normal range for growth and reproduction (19-32°C) for *Hirudinaria manillensis* [22, 29]. Hatching number for cocoons was significantly influenced by temperature, light intensity and diet, with the highest obtained (6.23±0.25) under the temperature regime of 27-28°C with light intensity 0 lx and diet fed with fresh eel blood. However, hatching rate was not significantly influenced as is shown in Table 4. In the study conducted by Tan *et al*. [26] with *H.hainana* each cocoon produce 6-17 juveniles with a hatching rate of 77.4 %. In contrast, the present study showed that the growing condition with low temperature and low light intensity and fed with fresh eel blood gave the highest hatching rate with mean and standard deviation of 95.23 ± 8.26 %. Other than the inherent inter-specific differences between *Hirudinea* sp. and *H. hainana*, the differences in the culture preparation between Tan *et al*.'s study and this study may explain the higher number in *Hirudinea* sp.

In this study, the different treatments significantly influenced the size and wet weight of the cocoons that were produced, with the largest cocoons produced under the treatment which had low temperature, no light intensity and fed with fresh eel blood. Cocoon sizes in this study were approximately equal to the size (about 22 mm in mean length and 13 mm in mean diameter) reported by Tan *et al*. [29]. Generally, the wet weight of leech cocoons can be markedly different between leech species, e.g. 1.6-2.0 g in *Whitmania pigra* [30] and 0.15-0.18 g in *H.hainana* [26]. In this study, the wet weight of the cocoons ranged from 1.26±0.11 g under the low temperature, zero light intensity and fed with fresh eel blood to 0.22±0.38 g under the condition fed with booster at high temperature and high light intensity which gave the lowest wet weight of cocoon.

Water quality, temperature and parasitism are known to significantly influence the survivorship of the leech species [31, 32, 34]. Life-span of leech was also one of the key impediments for leech culture [25]. In the present study, it was found that the different conditions of temperature, light intensity and diet could also markedly influence the survival rate of the parent leeches. A higher temperature and light intensity led to greater mortality as the growth condition was probably too extreme a result which was different with the study conducted by B. Zhang *et al*. [28] where broodstock density had a significant influence on the survival rate of leeches. In this study, many leeches were found to be infected by parasitic protozoans and flatworms at the higher temperature and light intensity during the course of the experiment, which greatly influenced the survival and growth of the leeches (Fig.3).

Figure 3: Dead leeches infected by parasitic protozoans and flatworms

CONCLUSION AND RECOMMENDATION

This investigation has demonstrated that temperature, light intensity and diet significantly affect the reproductive efficiency of the leech, *Hirudinea* sp. A growth condition at a temperature of 25-28°C and zero light intensity fed with fresh eel blood is recommended for the commercial breeding of this species.

ACKNOWLEDGEMENTS

The author is grateful to the Faculty of Agro Industry and Natural Resources for providing space and facilities to carry out the study. This study was funded by Universiti Malaysia Kelantan and supported by PT Dynamic Consultant Co., Kota Bharu, Kelantan and Freshwater Fisheries Research Centre, Gelami Lemi, Jelebu, Negeri Sembilan.

REFERENCES

[1] Gouda, H.A., 2006. The effect of peritrich ciliates on some freshwater leeches from Assiut, Egypt. Journal of Invertebrate Pathology 93, 143–149.

[2] Sawyer, R.T., 1986. Leech Biology and Behavior. Oxford University Press, New York.

[3] Mann, K.H., 1962. Leeches (Hirudinea): Their Structure, Physiology, Ecology and Embryology, p. 200. Oxford, London.

[4] Herter, K. (1968) Die medizinischen Blutegel und seine Verwandten. A. Zeimsen Verlag, Wittenberg Lutherstadt.

[5] Sawyer, R.T., 1981. Why we need to save the medicinal leech. Oryx 16, 165-168.

[6] Elliott, J.M., Tullett, P.A., 1984. The status of the medicinal leech *Hirudo medicinallis* in Europe and especially in the British Isles. *Biological Conservation* 29, 15–26.

[7] Wells, S., Coombes, W., 1987. The status of and trade in the medicinal leech. *Traffic Bulletin* 8, 64–69.

[8] Petrauskienė, L., 2003. Water and sediment toxicity assessment by use of behavioural responses of medicinal leeches. *Environment International* 28, 729–736.

[9] Trontelj, P., Utevsky, S.Y., 2005. Celebrity with a neglected taxonomy: molecular systematics of the medicinal leech (genus Hirudo). *Molecular Phylogenetics and Evolution* 34, 616–624

[10] 406th Medical Laboratory special report on Blood Sucking Asia Leeches of Families Hirudidae & Haemadipsidae, July 1968. United States Army Medical Command, Japan.

[11] Flerov, B.A., Lapkina, L.N., 1976. Avoidance of some toxicants by medicinal leech. *Inform. Bull. IBVV*. 30, 48–52 (In Russian).

[12] Lapkina, L.N., Flerov, B.A., 1979. Impact of some toxicants on leech in acute toxicity test. Proc. *Freshwater Biol. Inst. Academic Science USSR*. 38 (41), 50–59 (In Russian).

[13] Lapkina, L.N., 1992. Comparative study of lethal and sublethal effects of trichlorphon on leeches. *Information bulletin IBVV. RAN*. 94, 67-73 (In Russian).

[14] Huguet, G., Molinas, M., 1992. Changes in epithelial cells in *Hirudo medicinalis* during wound healing. *Journal of Invertebrate Pathology* 59, 11–17.

[15] Huguet, G., Molinas, M., 1996. Myofibroblast-like cells and wound contraction in leech wound healing. *Journal of Experimental Zoology* 275, 308–316.

[16] Blackshaw, S.E., Nicholls, J.G., 1995. Neurobiology and development of the leech. *Journal of Neurobiology* 27 (3), 267–276.

[17] Petrauskienė, L., 2001. Water toxicity assessment using medicinal leeches. *Aquatic Ecosystem Health & Management* 4, 203–208.

[18] Steiner, V., Knecht, R., Gruetter, M., Raschdorf, F., Gassmann, E., Maschler, R., 1990. Isolation and purification of novel hirudins from the leech Hirudinaria manillensis by high-performance liquid chromatography. *Journal of Chromatography B: Biomedical Sciences and Applications* 530, 273–282.

[19] Electricwala, A., Hartwell, R., Scawen, M.D., Atkinson, T., 1993. The complete amino acid sequence of a hirudin variant from the leech *Hirudinaria manillensis*. *Journal of Protein Chemistry* 12 (3), 365–370.

[20] Singhal, R.N., Davies, R.W., 1996. Effects of an organophosphorus insecticide (Temephos) on gametogenesis in the leech *Hirudinaria manillensis* (Hirudinidae). *Journal of Invertebrate Pathology* 67 (1), 100–101.

[21] Sawyer, R.T., Lepont, F., Stuart, D.K, Kramer, A.P., 1981. Growth and reproduction of the giant Glossiphoniid leech Haementeria ghilianii. *Biological Bulletin* 160 (2), 322-331.

[22] Yang, T., 1996. Fauna sinica (Annelida Hirudinea). Science Press, Beijing, China, pp. 117-129 (In

[23] Mason, T.A., Mcllroy, P.J., Shain, D.H., 2004. A cysteine-rich protein in the Theromyzon (Annelide: Hirudinea) cocoon membrane. FEBS Letters 561, 167-172.

[24] Marotta, R., Shain, D.H., 2007. Irregular helicoids in leech cocoon membranes. *Journal of Structural Biology* 158, 336-343.

[25] Mann, K.H., 1957. The breeding, growth and age structure of a population of the leech *Helobdella stagnalis*(L.). Journal of Animal Ecology 26(1), 171-177.

[26] Tan, E.G., Chen, J., Qian, Y.T., 1992. Growth, feeding and reproduction of the leech *Haemadipsa hainana* Song. Journal of Hainan University: Natural Science 10 (1), 16-20 (In Chinese).

[27] Collins, H.L., Holmstrand, L.L., 1984. Indicators of sexual maturity In the leech, *Nephelopsis obscura* (Annelida: Hirudinea). *American Midland Naturalist* 112(1), 91-94.

[28] Bin Zhang, Qiang lin, Junda Lin, Xialing Chu, Junyi Lu, 2008. Effects of broodstock density and diet on reproduction and juvenile culture of the Leech, *Hirudinaria manillensis* Lesson,

1842. *Journal of Aquaculture* 276(2008), 198-204.

[29] Tan, E.G., Huang, L.Y., Guan, Y., Wang, B., 2002. Studies on growth and reproduction of *Hirudinaria manillensis* in Guandong province. *Chinese Traditional and Herbal Drugs 33 (9), 837-840 (In Chinese).*

[30] Shi, H.Z., Liu, F., Guo, Q.S., 2006a. Studies on impact of temperature and weight in *Whitmania pigra* bred. China Journal of Chinese Materia Medica 31 (24), 2030-2032 (In Chinese).

[31] Sawyer, R.T., 1970. Observations on the natural history and behavior of *Erpobdella punctata* (Leidy) (Annelida:Hirudinea). American Midland Naturalist 83 (1), 65-83.

[32] Tan, E.G., 2005. Chemical environment in live water of the leech, *Hirudinaria manillensis. Chinese Traditional and Herbal Drugs 36 (10), 1561-1563 (In Chinese)*.

[33] Shi, H.Z., Liu, F., Guo, Q.S., 2006b. Studies on growth and intake law of *Whitmania pigra* with temperature. China Journal of Chinese Materia Medica 31 (23), 1994-1946 (In Chinese).

Rapid Microwave Synthesis and Partial Characterization of Carbon Nanotubes

Raziah, A.Z; Junizah, A.R. and Saifuddin, N.
College of Engineering, Universiti Tenaga Nasional
Jalan Ikram-UNITEN, 43009 Kajang, Selangor, Malaysia
aji_caliesto@yahoo.com; junizah_ar@yahoo.com; saifuddin@uniten.edu.my

Abstract
Carbon nanotubes (CNTs) have been synthesized by heating cotton ball soaked with mixture of castor oil and catalyst metals (Fe/Co) supported by silica gel under microwave radiation. The chemical vapour deposition (CVD) method was then carried out in a microwave chamber using a novel low temperature. The use of oil-liquid matter-causes no leakage, requires no vacuum conditions during synthesis and the synthesis is environmental friendly. The present method allows low-temperature synthesis of carbon nanotubes in a large amount at high percent conversion and reducing production cost, as compared with the conventional production method employing other organic compound as raw material. The morphology and characterization of the CNTs are studied and discussed by scanning electron microscopy (SEM) and transmission electron microscopy (TEM).

Keywords
Carbon nanotubes (CNTs), natural oil, Microwave, Chemical vapour deposition (CVD)

INTRODUCTION

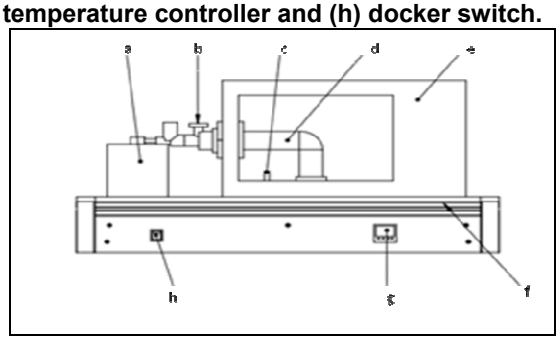
Since they were discovered in 1991 by Iijima in carbon soot made by arch-discharge [1], carbon nanotubes (CNTs) are attracting much interest for their physicochemical properties, such as ordered structure with high aspect ratio, high mechanical strength, high electrical conductivity, high thermal conductivity, and high surface area [2-4]. Currently, carbon nanotubes (CNTs) are generally produced through the CVD method employing raw material gas such as methane [5]; the arc discharge method employing a solid raw material such as polymer material, polyvinyl alcohol (PVA) [6]; or the laser ablation method [7]. CNTs produced through any of these methods are expensive, because of high costs for raw materials and apparatuses. Furthermore the conventional production method usually employed organic compound as carbon precursor such as methane, benzene or toluene.

In this study CNTs will be synthesized by using castor oil under microwave radiation at a comparatively low temperature. Natural resources present in the natural world and recycled raw materials will come to be employed from environmental considerations. In addition, oils that are consumed via combustion are required to be fixed as CNTs, from the viewpoint of reduction in amount of carbon dioxide emitted to the atmosphere. This method allows low-temperature synthesis of CNTs in a large amount at high percent conversion and reducing production cost, as compared with the conventional production method. The carrier gas to be used can possibly be a reducing gas such as hydrogen, which has been conventionally employed in vapour growth synthesis of CNTs. However in the present method, an inert gas is preferably employed-nitrogen in which high percent conversion can also be attained.

EXPERIMENTAL

In this method, a mixture of iron nitrate nonahydrate and cobalt nitrate hexahydrate was used as catalyst. 3g of each catalyst source was mixed and heated until a uniform melt was obtained. After that, silica gel was slowly added. Fig. 1 shows the drawing of the microwave processor with built-in infrared thermometer as thermal indicator. A quartz boat containing cotton ball soaked with castor oil and catalyst which was prepared beforehand was placed in a 'bent' glass tube (d). The 'L' shape glass tube was installed in the built-in infrared thermometer (c) microwave chamber (e). Nitrogen gas from the gas tank (a) was utilized to flush out air from the glass tube with gas flow at 100ml/min. The flow rate was controlled by the manual valve (b). The microwave was heated to a temperature ranging between 300-400°C at power output of 550W for 15 minutes. After completion of reaction the product was collected and measured in terms of mass. Surface morphology of CNTs was characterized by SEM and TEM (Philips EM 400).

Fig. 1. Microwave processor for chemical vapour deposition (CVD) method. (a) Nitrogen gas tank, (b) manual valve, (c) IR temperature sensor, (d) L shape glass, (e) microwave chamber, (f) structure, (g) IR temperature controller and (h) docker switch.



RESULT AND DISCUSSION

The SEM micrographs of CNTs produced by the present method are shown in Fig. 2. It can be seen that the synthesized CNTs are long, thin and curved. The diameter and length of CNTs were approximately 10-20nm and 40μm.

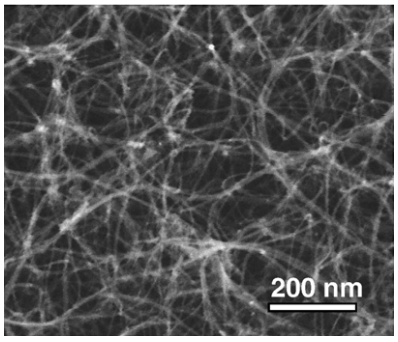
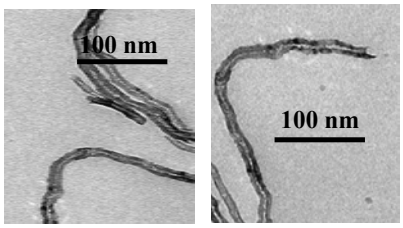


Fig. 2 SEM micrograph of carbon nanotubes produced at 300-400°C at power output of 550W.

TEM analysis was performed to determine the wall thickness of CNTs. From the result it indicated the thickness range from 4–7 nm. The TEM images as shown in Fig. 3 (a) and (b) also indicated that nanotubes were mostly multi-walled. It is also interesting to point out that the nanotubes diameter is larger than its wall thickness. The morphology of CNT in Fig. 2 (a) probably implies that there are defects exist in this nanotube.

The major benefit of this present method is high percent conversion of CNTs was obtained at lower production cost as compared to the conventional method. Lower temperature of heating process required low electrical power thus reducing production cost. Inexpensive raw material was also another factor in reducing production cost. The present of castor oil causes no leakage and requires no vacuum conditions during synthesis. In addition it is free from resource depletion and is friendly to the environment. This is a good step towards clean and green technology approach.



(a) (b)

Fig. 3. TEM micrograph of carbon nanotubes produced at 300-400°C at power output of 550W.

CONCLUSION

The synthesis of carbon nanotubes was carried out using chemical vapour deposition (CVD) method with microwave irradiation, castor oil as carbon source and Fe/Co as a catalyst metal. The results show that CNTs can be produced at relatively low temperature of 300-400 °C with shorten reaction time by using microwave irradiation. This and low-cost technique may have great potential and can be scaled up for mass production.

REFERENCES

[1] S. Iijima, Helical microtubules of graphitic carbon. *Nature* (London): 354 (56-58), 1991.

[2] P. Melissa, Goswami T., Carbon nanotubes – Production and industrial applications. *Materials and Design*: 28 (1477–1489), 2007.

[3] N.C. Jonathan, K. Umar, J. B. Werner, K. G. Yurii., Small but strong: A review of the mechanical properties of carbon nanotube–polymer composites. *Carbon*: 44 (1624–1652), 2006.

[4] N.P. Valentin, Carbon nanotubes: properties and application, *Materials Science and Engineering R*: 43 (61–102), 2004.

[5] L. Haipeng, Z. Naiqin, H. Chunnian, S. Chunsheng, D. Xiwen, L. Jiajun, Thermogravimetric analysis and TEM characterization of the oxidation and defect sites of carbon nanotubes synthesized by CVD of methane. *Materials Science and Engineering: A*: 473 (355-359), 2008.

[6] H.W. Yu, C.C. Sheng, M. L. Kuo, Y.L. Yuan, Formation of carbon nanotubes from polyvinyl alcohol using arc-discharge method, *Carbon*: 42 (2535-2541), 2004.

Adsorption of Uranium (VI) from Aqueous Solution onto Microwave Grafted, Cross-Linked *Chitosan* with *Saccharomyces Cerevisiae*

Sultanbayeva Dinara and Saifuddin, N
College of Engineering, Universiti Tenaga Nasional
Jalan Ikram-UNITEN, 43000 Kajang, Selangor, Malaysia
d_sultanbayeva@yahoo.com; saifuddin@uniten.edu.my

Abstract
Uranium mining contaminates not only the surface water, but also the groundwater as the uranium leak out from mining discharges. Among the large amount of bioagents the most highly-effective biosorbents - the yeast Saccharomyces Cerevisiae which is widely used in food industry and multi-functional biopolymer Chitosan. Chitosan has excellent ability for heavy metals adsorption due to the high quantity of amino groups in chitosan chains. In order to enhance the resistance of chitosan against acid, alkali and chemicals as well as increasing chitosan adsorption ability and mechanical strength, cross-linking reaction is a crucial step. The yeast biomass has been beneficially used as biosorbent for removal of many metal ion from aqueous solution. Cross-linked chitosan beads was synthesized by the reaction of chitosan with epichlorohydrin (ECH). Cross-linked chitosan beads were grafted with S. Cerevisiae under microwave irradiation. The representative microwave synthesized graft composite was characterized by Fourier transform-infrared spectroscopy, taking chitosan as a reference. Adsorption of uranium (VI) from aqueous solution onto adsorbent was investigated in a batch system. The influence factors on uranium (VI) adsorption were also investigated and described in detail, such as contact time, pH value and initial uranium (VI) concentration. Results also showed that the cross-linked chitosan with S. cerevisiae was a favorable adsorbent.

Keywords
Uranium (VI) sorption, Chitosan, *Saccharomyces cerevisiae*

INTRODUCTION

Uranium is a toxic radioactivity element. It is usually found in the environment in the hexavalent form. Excessive amounts of uranium have entered into environment through the activities of nuclear industry [1]. Uranium disposed into the environment can eventually reach the top of the food chain and be ingested by humans, causing severe kidney or liver damage and even death [2]. For example, Kazakhstan faces several important environmental problems caused by heavy metal pollution. Kazakhstan also has over thirty uranium mines, which make the problem of uncontrolled release of radioactivity extremely important. Pollution from industrial and agricultural sources has also influenced the nation's water supply. Excessive amounts of uranium have entered into environment through the activities of nuclear industry. Therefore, it is necessary to treat wastewaters containing uranium in order to prevent radioactive contamination of the environment.

Various techniques are employed for the removal of uranium ions from wastewaters and radioactive wastes. Chemical precipitation, membrane processes, ion exchange, solvent extraction, photocatalysis and adsorption are the most commonly used methods [3-6]. Adsorption of uranium (VI) onto various solids is important from purification, environmental, and radioactive waste disposal points of view [7].

In recent years, attention has been focused on various adsorbents with metal-binding capacities and low cost, such as chitosan, zeolites, clay or certain waste products [8]. Among the large amount of bioagents the most highly-effective biosorbents - the yeast *Saccharomyces Cerevisiae* which is widely used in food industry and multi-functional biopolymer Chitosan. Chitosan is a kind of polymer made up of glucosamine, which is prepared from chitin by partially deacetylating its acetamido groups with a strong alkaline solution. Chitosan has been reported to have high potential for adsorption of metal ions due to its high contents of amino and hydroxy functional groups [8]. However, chitosan is soluble in aqueous organic acids such as acetic acid, formic acid, etc., as well as inorganic acids, to give a viscous solution. In order to enhance the resistance of chitosan against acid, alkali and chemicals as well as increasing chitosan adsorption ability and mechanical strength, cross-linking reaction is a crucial step [9]. The yeast biomass has been beneficially used as biosorbent for removal of Ag, Au, Cd, Co, Cr, Cu, Ni, Pb, U, Th and Zn from aqueous solution. *S. cerevisiae* deserve a special attention for it efficient sorption abilities like toxic metal removing and radionuclide cleaning from aqueous solution. *Saccharomyces cerevisiae*, is widely used in food and beverage industries. It is easily cultivated, and can be obtained from various food and beverage industries. It should be noted that *S. cerevisiae* can distinguish different metal species based on their toxicity, such as selenium species (Se

(IV) and Se(VI)), antimony species (Sb(III) and Sb (V)) and mercury species (CH_3Hg and Hg(II)). This kind of property makes *S. cerevisiae* useful not only for the bioremediation, removal or recovery of metal ions, but also for their analytical measurement [10-12].

In industrial operation, immobilization is recognized as an effective method used to overcome the incorporating free suspended cells in wastewater treatment. It offers several advantages including minimal clogging in continuous systems. Moreover, cell immobilization can enhance its stability, reusability, mechanical strength and the ease of treatment. The technique has been well used to remove toxic heavy metals from an aqueous solution. Immobilized biomass, however, has major disadvantages such as cost, cell leakage strengths, instability at low pH, poor mechanical and rate-limitation in diffusion. Several biopolymers such as alginate, agarose, cellulose acetate and gluteraldehyde are widely used as immobilization matrices as they are non-toxic, efficient and inexpensive [13]. Chitosan has undoubtedly been one of the most popular adsorbents the removal of metal ions from aqueous solution as well as supporting material for immobilization of microbial biosorbents [14].

This paper studies the potential of immobilizing *S. cerevisiae* on the surface of chitosan-coated magnetic nanoparticles for adsorption of uranium from aqueous solution. After a batch of experiments, the new magnetic adsorbent exhibited significantly high capability for the adsorption of uranium. The biosorption process was studied with regard to the effects of initial pH, initial uranium concentration and contact time.

MATERIALS AND METHODS.

Chemical and reagents

The microorganism *S. cerevisiae* was obtained from Microbiology Department University of Malaya Kuala Lumpur, Malaysia. Chitosan was purchased from Fluka as a flaked material, with a deacetylation percentage of approximately 87%. Epichlorohydrin (ECH), and ethylene glycol diglycidyl ether (EGDE) purchased from Fluka were analytical-reagent grade. The uranium (VI) was prepared using as $UO_2(NO_3)_2{\cdot}6H_2O$ (ACS grade) which was purchased from Merck, Germany. All the reagents used were of analytical-reagent grade and used as received. Ultrapure deionized water was obtained using the ELGA LabWater (UK) water purification system in our laboratory and was used to prepare all the solutions.

Saccharomyces cerevisiae cultivation

The S. cerevisiae was enriched in a liquid nutrient medium which contained peptone 30.0 g L^{-1}, glucose 50.0 g L^{-1}, yeast extract 10.0 g L^{-1}, $MgSO_4{\cdot}7H_2O$ 0.5gL^{-1}, $KH_2\ PO_4$ 1.0gL^{-1}, $NH_4)_2SO_4$ 1.0gL^{-1}, NaCl 0.5 g L^{-1}, and $ZnSO_4$ 0.01 g L^{-1}. The strain was incubated in flasks stirred at 150 rpm and 301 K. The cultivated cells were harvested after 24 h, then centrifuged at 3500 rpm for 20 min and washed with sterile water and re-centrifuged twice. Afterwards, the active cells were evaporated for 24 h.

Preparation of macroporous chitosan beads

Chitosan beads were prepared as reported elsewhere with some modification [15-17]. In our work, 3.0 g chitosan dissolved in 100 mL, 2% (v/v) acetic acid. The solution was dropped through a seven-gauge needle into 2.0 M sodium hydroxide solution, and the gelled spheres formed instantaneously. This process was accomplished by using a model 100 push–pull syringe pump. The formed chitosan beads were kept in the sodium hydroxide solution for 24 hours and washed with distilled water until the washing solution became neutral. After filtering the beads (hereafter called chitosan beads) were stored in distilled water for later use.

Preparation of cross-linked chitosan with microwave irradiation

Cross-linked chitosan beads were prepared using epichlorohydrin (ECH) as the cross-linking agents following a novel microwave irradiation method modified from the previously mentioned method [15,18]. A solution of 0.04 M epichlorohydrin solution containing 0.067 M sodium hydroxide was prepared (pH=10). Freshly prepared, 20 g of wet chitosan beads (using filter to absorb the surface water) were put into a flask with 100 ml of the epichlorohydrin solution and stirred to allow proper mixing. The mixture was subjected to several (about 12) short burst of microwave irradiation using a microwave oven at frequency of 2.45 GHz at power output of 200 W. Each short burs of irradiation lasted for 1minute. The mixture was cooled (35-40 seconds at room temperature) between each irradiation. This ramp/cool cycle was repeated 12 times. After the 12th cycle (total time required about 25-30 minutes), the cross-linked beads were filtered and washed extensively with distilled water to remove any unreacted epichlorohydrin until the washing solution became neutral (the neutrality measured by universal indicator paper) and air dried. The diameter of the wet cross-linked bead was approximately 1.75±0.05 mm. The newly formed cross-linked beads (hereafter called chitosan-ECH beads) obtained were confirmed by a Perkin-Elmer FT-IR System 2000 Model spectrometer.

Characterization of cross-linked chitosan beads

The amine content of the cross-linked chitosan beads was determined titrimetrically. Cross-linked chitosan beads (1.0 g) (filter paper used to absorb the surface water) were added to 0.1 M hydrochloric acid (20

ml); the mixture was left to stand for 16 hours in a tightly closed bottle. The mixture was filtered, and the filtrate (5 ml) was titrated with a 0.1 M sodium hydroxide. The surface morphology of the wet beads was studied using an environmental scanning electron microscope (ESEM Philips Xl30). Samples containing water without drying were mounted on metal stubs and at low vacuum degree (~10^{-3} atm) and relatively low temperature (near 0^{o}C) observed.

Dissolution and swelling test of chitosan

Chitosan and cross-linked chitosan beads were tested with regard to their solubility in each of 5% (v/v) acetic acid, distilled water and 0.10 M sodium hydroxide solution by adding 0.10 g of chitosan and cross-linked chitosan beads in each of the dilute acid, distilled water and dilute alkaline solutions for a period of 24 hours with stirring.

The swelling studies of chitosan and cross-linked chitosan beads were carried out in distilled water at room temperature for a period of 24 hours. The percentages of swelling of these beads were calculated by using the following equation (eq. 1):

$$\text{Percentage of swelling} = \frac{W_s - W}{W} \times 100\% \quad (1)$$

where W_s is the weight of swollen beads (g) and W is the weight of dry beads (g).

Immobilization of S. Cerevisiae onto cross-linked chitosan under microwave irradiation.

The crossed-linked chitosan particles was dispersed in the bottle containing phosphate buffer solution (pH = 7) and was kept at room temperature. After 3 h, *S. cerevisiae* which dispersed in sodium chloride solution was added in the bottle. The mixture was agitated using mechanical shaker at 200 rpm for 1 h. Then the mixture irradiated in microwave oven at frequency of 2.45 GHz at power output of 200 W for 5 minutes. It was removed from the microwave and agitated for 10 min at 200 rpm followed by another round of microwave irradiation for 5 min at 200 W. Finally, the *S. Cerevisiae* immobilized onto cross-linked chitosan (hereafter called SCC) was separated, washed with sodium chloride solution and distilled water several times.

Batch adsorption studies

Batch adsorption experiments were carried out by using the SCC as the adsorbent. A series of conical flasks containing uranium solutions with initial concentrations of 100 mg·L^{-1} and a known dosage of the SCC were shaken in a mechanical shaker with a speed of 100 rpm until the system reached equilibrium. The experiments indicated that two hours was adequate at ambient temperatures for the equilibrium to be reached. Before shaking, the pH value of the solution was adjusted with 0.5 M HCl or 0.5 M NaOH to cover a range from 2.0 to 9.0, which was measured using a Hannah pH meter. After filtration, the concentration of uranium in the supernatant was analysed by Arsenazo-III spectrophotometric method on a Shimadzu UV-vis -1601 spectrophotometer [19]. Three replicates were used at least to get each adsorption datum, and the standard deviations were less than 2% on the average. The adsorption amount was calculated based on the difference in the uranium concentration in the aqueous solution before and after adsorption, according to the following equation:

$$q_e = \frac{(C_0 - C_e)V}{W}$$

where C_0 and C_e are the initial and equilibrium concentrations of uranium, in mg·L^{-1} respectively, V is the volume of uranium solution, in L, and W is the mass of the SCC used, in g.

Determination of uranium (VI) in solution

Concentration of uranium (VI) was analyzed with the Arsenazo-III spectrophotometric method on a Shimadzu UV-vis -1601 spectrophotometer [19]. Analar grade disodium salt of arsenazo-III (2,7-bis(2-arsenophenylazo)-1,8-dihydroxynaphthalene-3,6-disulfonic acid) and perchloric acid (70–72%) purchased from E. Merck were used. A uranium standard solution (100 ppm (w/v)) was prepared from analytical reagent grade uranyl nitrate hexahydrate in 3 M of $HClO_4$. Arsenazo-III (0.07% w/v) solution was prepared in 3 M of $HClO_4$.

For construction of calibration curve, one mL of uranium standard solutions (containing 1–16 μg.g^{-1}), 5 mL chloroacetic acid ($ClCH_2COOH$)–sodium acetate (CH_3COONa) buffer solution (pH 2.5) and 1.0 mL 0.1% Arsenazo-III aqueous solution were added to a glass flask, respectively, the final solution volume was filled up to 25 mL by adding deionized water. After 10 min at room temperature, the absorbance of the mixture liquid was measured at 652 nm against the reagent blank. For determination of uranium in the samples, the uranium standard was replaced with 1 mL of the sample. Concentration of uranium was read off from the calibration curve. All readings were carried out in triplicates.

RESULTS AND DISCUSSION

The characterization of the chitosan beads and cross-linked chitosan beads

As observed from our previous work, the Fig. 3.1 (a) and (b), shows the surface morphologies of the chitosan beads where pores with different size were observed and the average pore size of the beads were calculated to be 5.4 μm [20]. The SEM images of cross-linked chitosan-ECH beads after ground and sieved are depicted in Fig. 3.2. It can be seen that

there is a significant difference in surface morphology of the two forms of chitosan beads. A striking feature of the chitosan-ECH beads image was that the appearance were noted to have much asperity and to be more coarsely grained, more porous and rough internal structure. This may offer more adsorption sites for adsorbate (acrylamide binding for MIP preparation). Site accessibility, mass transport and hydrodynamic properties are significantly improved by producing porous beads [21]. The cross-linked chitosan beads had average pore size of 4.1 µm [20]. This result also indicates that chitosan has been chemically modified [22].

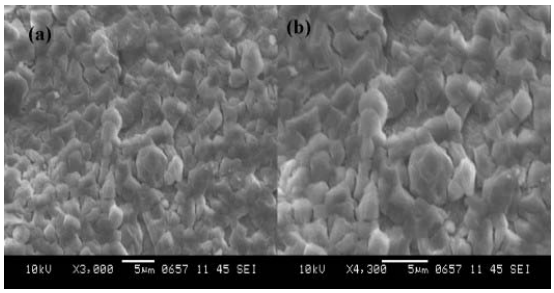


Fig. 3.1: SEM images showing the surface morphologies of the chitosan beads; (a) at 3000× and (b) 4300× magnifications.

Epichlorohydrin was selected as a convenient base catalyzed cross-linking agent. The advantage of using ECH as a cross-linking agent is that it does not eliminate the cationic amine function of chitosan, most notably, the crosslinking with ECH can considerably improve the wet strength of the chitosan beads [23,24]. An analysis of the cross-linked chitosan beads gave 0.18 mmol of amine content per gram wet beads (the water content was 93.5%); that means about 18% amine groups were cross-linked with epichlorhydrin. Obviously, this analytical result indicates that there are enough amine groups in the accessible positions of the cross-linked matrix. The analysis of Chitosan-ECH gave 0.25 mmol of carboxyl content per gram wet beads (water content was 85.3%). That means that the vinyl group content was above 0.25 mmol/g and that most amine had reacted with epichlorohydrin. The reaction of chitosan with epichlorohydrin in an acidic condition might be cross-linked at hydroxyl groups to form the epichlorohydrin cross-linked chitosan product, as shown in Fig. 3.4, which is similar to the scheme that has been reported previously [23,24].

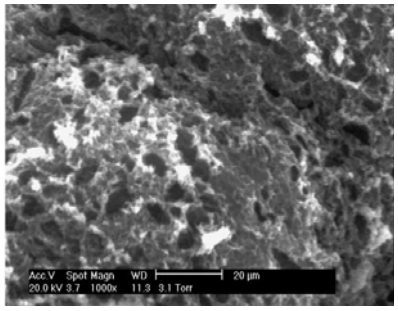


Fig. 3.2 ESEM microphotograph of cross-linked chitosan bead (X 1000)

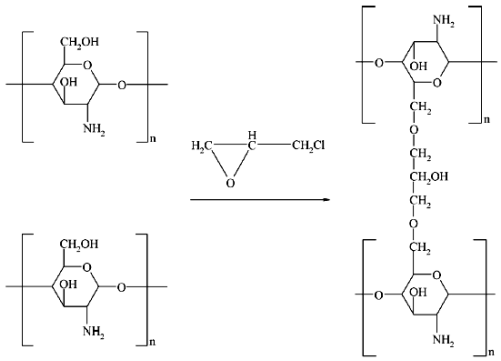


Fig. 3.4. Schematic representation for the cross-linking reaction of chitosan with epichlorohydrin.

Solubility and swelling test of chitosan

After cross linking with epichlorohydrin, the cross-linked chitosan (Chitosan-ECH) was found to be insoluble in acidic and alkaline medium as well as distilled water. It is well known that the high hydrophilicity of chitosan beads or raw chitosan are due to primary amine groups, which makes chitosan easily soluble in dilute acetic or formic acid solutions to yield a hydrogel in water. Therefore, the crosslinking treatment of chitosan reinforces its chemical stability in organic acidic media, making it useful for the removal of chemical pollutants from wastewaters in acidic solution.

The swelling behaviour of chitosan improved after cross-linking. It was observed from our earlier studies that chitosan beads had 37.5% and 32.6% sweeling when allowed to remain in distilled water and 0.1 M NaOH solution respectively for 24 hours at room temperature. However the swelling for cross-linked chitosan beads was only 15.3% in distilled water and 11.8 % in NaOH under similar conditions [20]. Hence, the change in the swelling percentages between chitosan beads and cross-linked chitosan beads gives a preliminary indication that cross-linking enhances the physical strength of the chitosan beads. Therefore, cross-linking modification is not only able to increase the surface area and reinforce the chemical strength of the chitosan beads but also reduces the

swelling of the beads. Thus, cross-linking treatment increases the rigidity and also the chemical stability of the beads. It is interesting to note that, the less swelling behaviour of cross-linked chitosan beads is important in order for it to be used in an adsorption column.

Infra Red spectra of chitosan derivatives

The characteristic IR absorption peaks of chitosan were observed (Fig 3.5a), which included a broad and strong band ranging from 3200-3700 cm^{-1} (stretching vibration of O-H and extension vibration of N-H). The peaks located at 2920 and 2869 cm^{-1} can be assigned to asymmetric and symmetric $–CH_2$ groups. The peak located at 1652 is characteristic of amine deformation. The prominent peak at observed at 1375 cm^{-1} represents C-N stretching. The peak at 1258 cm^{-1} can be attributed to the C–O–C stretching. The peak at 1082 cm^{-1} is characteristics of C-O stretching vibration. The absorption band at 900 cm^{-1}, corresponds to the characteristic absorption of β-D-glucose unit. The infrared spectrum of epichlorohydrin cross-linked chitosan was rather similar to that of chitosan (Fig. 3.5b), since the functional groups of epichlorohydrin were also present in chitosan. Therefore, the same vibrations were observed but with different relative intensities. The absorption intensity of $–NH_2$ group and –OH group (peak 3200 – 3700 cm^{-1}) from cross-linked chitosan is obviously lower than that of $–NH_2$ group and –OH group from chitosan, which indicates cross-linked reaction occurred between chitosan and epichlorohydrin. Moreover, the reduction in the intensities at 1418 cm^{-1} peak (primary amino group,–NH_2) showed that most of the primary amino groups were involved in the cross-linking process.

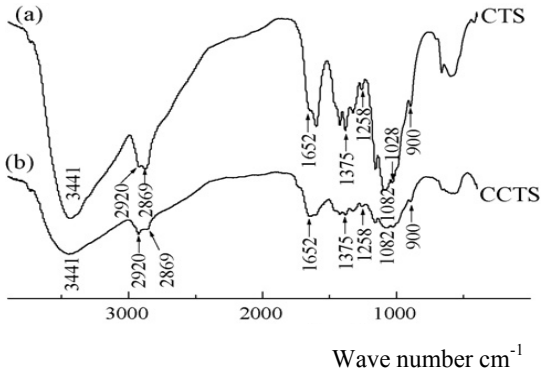


Fig. 3.5. FT-IR spectra (a) Chitosan (labelled as CTS) and (b) epichlorohydrine cross-linked chitosan (labelled as CCTS), using KBr pellets. The range from 4000 to 400 cm^{-1} was scanned.

Effect of pH on adsorption

The pH of the aqueous solution is an important controlling parameter in adsorption processes. The binding of metal ions by surface functional groups is strongly pH dependent. The effect of solution pH on the adsorption has been investigated over the range from 2.0 to 9.0, and the results are shown in Fig. 3.6. The uptake capacity of uranium increases when the solution pH is increased from 2.0 to 6.0. The explanation may be that, at a lower pH, the amine groups on CMC surfaces are easily protonized, inducing an electrostatic repulsion of uranium ions. The maximum adsorption capacity occurs at pH 6.0 in the concentration range studied. The adsorption amount decreases significantly in the range of 7.0 - 9.0. Similar observations have been reported by Sankararamakrishnan et al., 2006 and Juang & Shao, 2002 [25,26]. The optimal pH of 6.0 was selected for further study in the experiments.

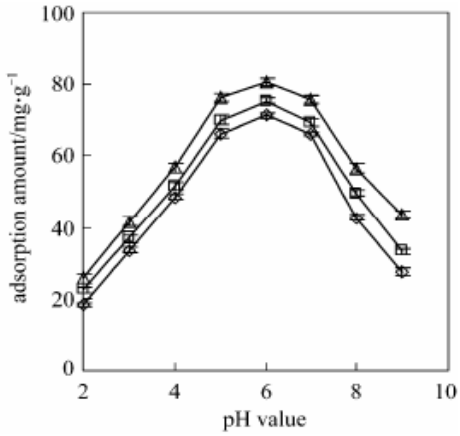


Figure 3.6: The effect of pH on the adsorption amount
◇ 50 mg·L^{-1} □ 100 mg·L^{-1} ; △ 150 mg·L^{-1}

Effect of contact time on adsorption

The effect of contact time on the amount of adsorption has been investigated over the range from 10 to 80 min with three initial Uranium concentrations of 50, 100, and 150 mg·L^{-1} , and the results are shown in Fig. 3.7. The uptake amount of uranium increases with contact time but increases slightly after 60 min of contact time, indicating that the equilibrium is almost reached after 60 min. Therefore, the optimum contact time for adsorption of uranium is about 60 min.

The excellent adsorption characteristics of CCM for heavy metals can be attributed to (1) high hydrophilicity due to large number of hydroxyl groups of glucose units, (2) presence of a large number of functional groups (acetamido, primary amino, so that it can absorb heavy metal ions in wastewater treatment and/or hydroxyl groups) (3) high chemical reactivity of these groups and (4) flexible structure of the polymer chain [27].

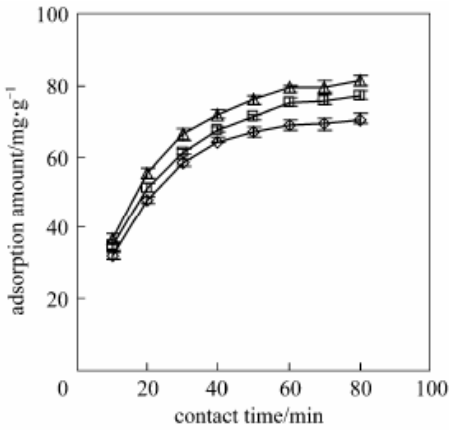


Figure 3.7: Effects of contact time on the adsorption behaviour
◇ 50 mg·L^{-1} ; □ 100 mg·L^{-1} ; △ 150 mg·L^{-1}

CONCLUSIONS

Cross-linked chitosan with epichlorohydrin and *S. cerevisiae* immobilized on cross-linked chitosan was prepared and characterized. The uranium adsorption behavior on the SCC was studied at different solution pH values and adsorption contact time. The optimal adsorption conditions of uranium on CMC were pH of solution 6.0 and adsorption time of 60 min.

REFERENCES

[1] Benedict, B. , T.H. Pigford, H.W. Levi, Nuclear Chemical Engineering,McGraw-Hill, New York, 1981.

[2] Xie, S.B., J. Yang, C. Chen, X.J. Zhang, Q.L. Wang, C. Zhang, Study on biosorption kinetics and thermodynamics of uranium by *Citrobacter freudii*, J. Environ. Radiact. 99 (2008) 126–133.

[3] Ganesh, R; K.G. Robinson, L.L. Chu, D. Kucsmas, G.D. Reed, Reductive precipitation of uranium by *Desulfovibrio desulfuricans*: evaluation of co-contaminant effects and selective removal,Water Res. 33 (1999) 3447–3458.

[4] Kryvoruchko, A.P.; L.Y. Yurlova, I.D. Atamanenko, B.Y. Kornilovich, Ultrafiltration removal of U(VI) from contaminated water, Desalination 162 (2004) 229–236.

[5] Donia, A.M.; A.A. Atia, M.M. Moussa, A.M. Sherif, M.O. Magied, Removal of uranium (VI) from aqueous solutions using glycidyl methacrylate chelating resins, Hydrometallurgy 95 (2009) 183–189.

[6] Sodayea, H.; S. Nisanb, C. Poletikoc, S. Prabhakara, P.K. Tewaria, Extraction of uranium from the concentrated brine rejected by integrated nuclear desalination plants, Desalination 235 (2009) 9–32.

[7] Saleem, M.; M. Afzal, R. Qadeer, J. Hanif, Selective adsorption of uranium on activated charcoal from electrolytic aqueous solutions, Sep. Sci. Technol. 27 (2) (1992) 239–253.

[8] Babel, S.; T.A. Kurniawan, Low-cost adsorbents for heavy metals uptake from contaminated water: a review, J. Hazard. Mater. B 97 (2003) 219–243.

[9] Wan Ngah, W.S.; A. Kamari, Y.J. Koay, Equilibrium and kinetics studies of adsorption of copper (II) on chitosan and chitosan/PVA beads, Int. J. Biol. Macromol. 34 (2004) 155–161.

[10] Madrid Y, Cámara C. Biological substrates for metal preconcentration and speciation. Trends Anal Chem 1997;16:36–44.

[11] Madrid Y, Cabrera C, Perez-Corona T, Cámara C. Speciation of methylmercury and Hg(II) using baker's yeast biomass (Saccharomyces cerevisiae). Determination by continuous flow mercury cold vapor generation atomic absorption spectrometry. Anal Chem 1995;67:750–4.

[12] Pérez-Corona T, Madrid Y, Cámara C. Evaluation of selective uptake of selenium (Se(IV) and Se(VI)) and antimony (Sb (III) and Sb (V) species by baker's yeast cells (Saccharomyces cerevisiae). Anal Chim Acta 1997;345:249–55.

[13] Sera, D.; P. Chattopadhyay, L. Ray, Cr (VI) biosorption by immobilized biomass of Bacillus cereus M116, J. Hazard. Mater. Subs. Res. 6 (2006) 1–23.

[14] Sun, S.,Wang, A., 2006. Adsorption kinetics of Cu(II) ions using N, O-carboxymethylchitosan. J. Hazard. Mater. 131, 103–111.

[15] Chandy, T., & Sharma, C. P. (1993). Chitosan matrix for oral sustained delivery of ampicillin. Biomaterials, 14, 939–944.

[16] Shu, X. Z., & Zhu, K. J. (2001). Chitosan/gelatin microspheres prepared by modified emulsification and ionotropic gelation. Journal of Microencapsulation, 18, 237–245.

[17] Guo TY, Xia YQ, Hao GJ, Song MD, Zhang BH. (2004). Adsorption separation of hemoglobin by molecularly imprinted chitosan beads. Biomaterial; 25:5905-5912.

[18] Wei, Y.C., Hudson, S.M., Mayer, J.M., Kaplan, D.C. (1992). **The crosslinking of chitosan fibers. J. Polym.** Sci., Part A: Polym. Chem. 30; 2187-2193

[19] Khan M.H., Peter Warwick P, Evans N. (2006) Spectrophotometric determination of Uranium with arsenazo-III in perchloric acid. Chemosphere 63 (2006) 1165–1169

[20] Saifuddin, N, Nur Yasumira, A.A. (2010). Microwave enhanced synthesis of chitosan-graft-polyacrylamide molecular imprinting polymer (MIP) for selective extraction of antioxidants. E-Journal of Chemistry, 7 (4), 67-79.

[21] Dai, S.; Zhang, Z; Liang, C. (2004). Hierarchically imprinted nanostructures for

separation of metal ions, in: J.A. Schwarz, C.I. Contescu, K. Putyera (Eds.), Dekker Encyclopedia of Nanoscience and Nanotechnology, CRC Press.

[22] Kamari, A; Wan Ngah, W.S.; Chong, M.Y. and Cheah, M.L. (2009). Sorption of acid dyes onto GLA and H_2SO_4 cross-linked chitosan beads. Desalination, 249, 1180–1189

[23] Wan Ngah, W.S., Endud, C.S., Mayanar, R. (2002). Removal of copper(II) ions from aqueous solution onto chitosan and cross-linked chitosan beads, React. Funct. Polym. 50, 181–190.

[24] Lee, S.H., Park, S.Y., Choi, J.H. (2004). Fiber formation and physical properties of chitosan fiber cross-linked by epichlorohydrin in a wet spinning system: the effect of the concentration of the cross-linking agent epichlorohydrin, J. Appl. Polym. Sci. 92, 2054–2062.

[25] Sankararamakrishnan, N., Dixit, A., Iyengar, L., Sanghi, R., "Removal of hexavalent chromium using a novel cross linked xanthated chitosan", *Bio*. *Technol*., **97** (9), 2377-2382 (2006).

[26] Juang, R.S., Shao, H.J., "A simplified equilibrium model for sorption of heavy metal ions from aqueous solutions on chitosan", *Water Res*., **36** (12), 2999-3008 (2002).

[27] Crini, G. Recent developments in polysaccharide-based materials used as adsorbents in wastewater treatment, Prog. Polym. Sci. 30 (2005) 38–70.

Review on Smooth Particle Hydrodynamics (SPH) in Blast Wave Simulation

Humaizi A[1,*], Agusril St[2], Norazman M.N[2], Alias Y[2]
[1]Pusat Pengajian Kejuruteraan Pembuatan, Universiti Malaysia Perlis
Kampus Ulu Pauh, 02600, Arau, Perlis, Malaysia
[2]Fakulti Kejuruteraan, Universiti Pertahanan Nasional Malaysia
Bangunan Bestari, Kem Sungai Besi, 57000, Kuala Lumpur, Malaysia
[*]humaizi@unimap.edu.my

Abstract
This paper will review the usage of Smooth Particle Hydrodynamics (SPH) in blast simulation. Basically SPH is a meshless method. It is different from Euler and Lagrange method where meshing must be set at the target region so that the computer can calculate it. Review on papers that discusses blast simulation reveals that SPH more preferable than Finite Element Analysis (FEA) due to its ability to cater for large deformation. This paper will discuss the disadvantages using Euler and Lagrange methods for blast simulation. Some examples of previous simulations using SPH will be discussed. Last but not least are some discussions on future works involving SPH.

Keyword
Smooth Particle Hydrodynamics (SPH), Regularized Smooth Particle Hydrodynamics (RSPH), Euler, Lagrange, Large deformation

INTRODUCTION

Smooth particle hydrodynamics (SPH) is an algorithm developed by Defense Evaluation and Research Agency (DERA) and Century Dynamics Ltd (CDL). The purpose is to simulate kinetic energy impact on soil and concrete targets. CDL is the company that develops AUTODYN. CDL have incorporated SPH into AUTODYN-2D. SPH is a gridless Lagrangian technique, hence grid tangling problems will not happen. [1].

Smooth Particle Hydrodynamics (SPH) is more accurate than Finite Element Analysis (FEA) and Finite Difference Method (FDM). This is because SPH is a gridless technique. Therefore it does not have problems related to grid tangling as in Lagrangian techniques. SPH bypasses the requirement for a numerical grid to calculate spatial derivatives like in Lagrange and Euler method [2] SPH uses particles or points rather than mesh as computational frame to interpolate. [3]. The smooth particles act as interpolation points to represent materials at discrete locations, so it can easily trace material interfaces, free surfaces and moving boundaries. [4].

Disadvantages of Lagrangian and Eulerian Methods in Finite Element Analysis

According to Liu [3] there are two main difficulties using traditional numerical methods in simulating blast. First, during detonation, there is a very thin reaction zone that divides the domain into two inhomogeneous parts and it produces large deformations. Secondly, outward moving gaseous detonation products during the dispersion process usually involves in free surfaces or moving interfaces if the explosion occurs within surrounding medium.

According to Langdon [5] Lagrangian method is used to model solid continua. Lagrange divides the structure into blocks using interconnected nodes which move with the material as it deforms. Langrage method is needed to represent critical areas of concrete structural behavior that are hydrostatic, compacted, yield, damaged, cracked and the effects on the reinforcement. In Lagrange processor, the grid distorts with the material.

Lagrange is actually computationally fast and gives good definition of material interfaces [2] The problems with Lagrange are that it cannot accurately resolve large deformations due to excessive grid distortions and tangling [1] In Langrange calculation, the grid moves with material velocity therefore the movement causes severe grid distortion of the Lagrangian grid. [6]. For Eulerian methods such as Finite Difference Method (FDM) is difficult to trace the free surfaces or moving interfaces [3]. The Lagrangian processor is used to track material interfaces while Eulerian processor is used to deal with regions where large deformation exists. Finite element method was generally used to model the structure behavior.

Euler processor is used for modeling fluids and gases. Euler processor is fixed grid though which material flows. Numerical grid is fixed in space while physical material flows through the grid. [7] Eulerian method is computationally expensive but is better for modeling large deformations and fluid flow [2]. According to Luttwak, Eulerian technique can handle most problems but have several drawbacks [6]. The drawbacks are;

- The advent of material through Euler grid can generate numerical diffusion which artificially smoothes gradients in the calculation.
- Difficult to adequately follow material interfaces which cut through the Euler cells especially if the material flows in direction diagonal to the fluid.
- Euler grid must cover regions where materials exist and also regions material is expected to flow during a calculation. Therefore memory requirements are so large that increases computing cost. Hence only coarse-grid calculations can be computed.

According to Liu [4] it is also very difficult to simulate underwater explosion phenomena by using traditional grid-based numerical methods due to inherent features such as large deformations, large inhomogeneities, moving interfaces and others.. Using traditional method, computational information is exchanged either by mapping or by special interface treatment between two meshes.

Problem Solved by Previous Research Using SPH

Given below are some examples of simulation using SPH.

Case 1: SPH to Study Kinetic Energy on Penetrator Upon Impacts on Multi-layered Soil and Concrete Targets.

In I997, Clegg et al in his research uses AUTODYN 2D to study the kinetic energy on penetrator upon impacts on multi-layered soil and concrete targets. They used smooth particle hydrodynamics application in AUTODYN 2D. Although at that time SPH is not yet mature but it does gives accurate result than Euler method.

Clegg et al had done experiments to compare results with SPH simulation. 20kg penetrators were fabricated from Ni, Fe, Co tungsten alloy with 90 mm caliber, length 300 mm and having an ogive nose with caliber head radius of 2.5mm. The penetrators were fired from 90mm smooth bore Howaster powder gun at nominal speed 520 m/s to a 3m diameter targets. High speed camera was used to capture the events.
They had make comparisons between SPH/Langrange, Euler/Lagrange and Lagrange/Lagrange simulation. They had found out SPH/Lagrange simulation gives detail view of cracks that happen during penetration impact. Figure 1 shows the comparison from those 3 simulations.

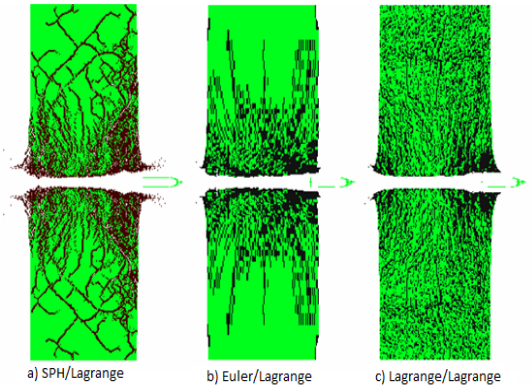


Figure 1: Comparison for SPH, Euler and Lagrange simulations [1]

From Figure 1, we can see that SPH/Lagrange simulation visualizes the size and shape of front spall and back scab. The openings of the cracks can be seen as the SPH particles separate. In grid based techniques, the opening of cracks only noticeable through the growth of failed zones/material which is very difficult to observe.

Case 2: Hard Penetrator in Ceramic Armour
Colin et al [2] had done experiments of hard penetrator impacting a ceramic armour. steel projectile was impacted by a ceramic (alumina) target backed by aluminum at 853 m/s. Brittle damage model was simulated to model the strength degradation of failed ceramic. Since Euler processor is difficult to include advance constitutive material models, Lagrange simulation was used. In Lagrange simulation, 120 zones were used to represent the projectile with ceramic and backing plate were represented by 420 uniform zones. For interfaces between material, slidelines were used.
For SPH simulation, 600 particles were used for projectile while 4879 particles represents the ceramic and backing plate. Constant smoothing length 0.38 mm was used. Figure 2 shows the simulation results for Lagrange and SPH simulations.

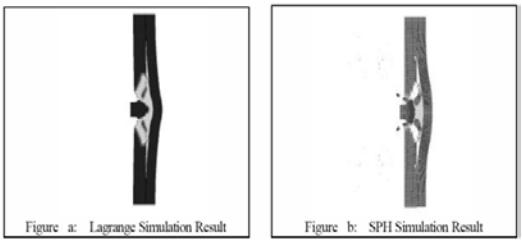


Figure 2: Comparison results from Lagrange and SPH simulation [2]

From the results, it seems that Lagrange and SPH results are quite the same. SPH shows a very distinct conical damage zone in ceramic. SPH requires finer

zoning than Lagrange but Lagrange needs three times number of cycles to complete the analysis. [2]

Future works and recommendations

SPH will be used to do simulation on blast wave in a confined area involving multi-material that is water, air and steel. Figure 3 shows the illustration of the structure to be simulated. The structure contains air at above and water at below. There is a small rectangular opening below the structure. The explosive will be inserted on the top of the structure. When it explodes, the blast wave will travel through the air, then through the water and ultimately exit to the surrounding air. The water will be forced out from the small opening.

The author had done simulation using MSc/Dytran to simulate the best angle that gives the highest pressure. [8]The simulation is done using Euler method in Finite Element Analysis. For simulation using SPH, the author plan to use ANSYS/AUTODYN. The author will simulate the burst of water from the small rectangular opening. Ultimately the author will simulate whether water burst from the small rectangular opening have enough pressure to cut through a hard object.

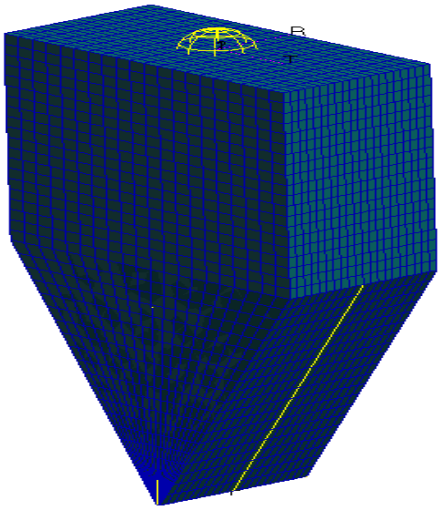


Figure 3: Structure to simulate using SPH involving multi-material [8]

CONCLUSION

Based on previous research on SPH. The author can conclude that to date SPH is most suitable for simulation involving large deformation like blast simulation and water distribution. SPH will be used in the future simulations involving blast.

ACKNOWLEDGEMENT

The author wishes to thank all supports given by supervisor, colleagues and technical team in doing this project. Appreciation is also given for Kementerian Pengajian Tinggi for issuing us FRGS grant in doing this project.

REFERENCES

[1] RA Clegg, J. S. (1997). The application of SPH techniques in AUTODYN-2D to kinetic energy penetrator impacts on multi-layered soil and concrete targets. *8th International Symposium on Interaction of the Effects of Munitions with Structure* .

[2] Colin J Hayhurst, R. A. (1996). The Application of SPH Techniques in AUTODYN-2D To Ballistic Impacts Problems . *16th International Symposium on Ballistics* .

[3] M.B. Liu, G. L. (2001). Computer simulation of high explosive explosion. *Computers & Fluids 32 (2003)* , 305–322.

[4] M. B. Liu, G. R. (2003). Smoothed particle hydrodynamics for numerical simulation. *Computational Mechanics 30 (2003)* .

[5] G.S. Langdon, I. R. (2009). Performance of mild steel perforated plates as a blast wave mitigation technique: Experimental and numerical investigation. *International Journal of Impact Engineering* , 1021-1036.

[6] Gabi Luttwak, M. S. (1999). Advanced Eulerian Technique for the Numerical Simulation of Impact and Penetration Using AUTODYN-3D. *9th International Symposium in Interaction of the Effects of Munitions with Structures* .

[7] X Quan, N. B. (2003). Numerical simulation of structural deformation under shock and impact loads using a coupled multi-solver approach. *5th Asia-Pacific Conference on Shock and Impact Loads on Structures* .

[8] A.Humaizi, N. M. (2010). Investigation of the Hydrodynamic Effect of Waterjet with Pressure Exceeding 1 GPa Cutting Through Solid Object. *Proceeding International Conference of Design and Concurrent Engineering* .

Segmentation Technique of Blast in Acute Leukaemia Blood Slide Images Based on K Means Clustering Procedure

Nor Hazlyna Harun[1], M.Y. Mashor[2], H .Rosline[3]
[1,2]Electronic & Biomedical Intelligent Systems (EBItS) Research GroupSchool of Mechatronic Engineering, University Malaysia Perlis,02600 Jejawi, Arau, Perlis,
[3]Hematology Department University Hospital, Univesity Science Malaysia,Kubang Kerian,Kelantan
roslin@usm.kb.my, hazlyna_harun@yahoo.com[1], yusoff@unimap.edu.my[2]

Abstract
The utmost tasks in image processing that will directly affect the post processing is image segmentation. Clustering algorithms is one of the common and popular as image segmentation techniques including medical image. In this study, proposes an automatic color image segmentation using combination of saturation component of HSI color space, k-means clustering and 7x7 pixels median filter. In the proposed automated color image segmentation technique, firstly saturation formula is used to ease the segmentation process. After that, k-means clustering is used to segment the acute leukemia blood cell images automatically. Then, 7x7 pixels median filter was applied to remove unwanted noise after the segmentation process was completed. Finally, seeded region growing area extraction (SRGAE), is use to extract the area for acute leukemia blast cells. The experimental results show that the proposed method has successfully segmented and distinguished the area of the blast for acute leukemia blood slide images from the complicated background and unwanted noise.

Keywords
Segmentation, acute leukemia blood cell images, k-means clustering, saturation formula and seeded region growing area extraction

INTRODUCTION

White blood cells (WBC) or leukocytes play an important role in the diagnosis of different diseases. Therefore, extracting information about that is useful for hematologists. For example, disease like leukemia is detected based on the amount and condition of the WBC [1]. There are two major kinds of leukemia: chronic and acute. About half of all leukemia patients suffer from the acute types, while half are badly affected with the chronic types. The word acute means the disease grow and progress rapidly [2]. Acute leukemia's come on unexpectedly, often within days or weeks, progressing rapidly and need to be treated immediately. This type of leukemia is divided into two categories, depending on the cell type involved. If the disease involves the lymphocytes it is called acute lymphocytic leukemia (ALL), but if it affects the myelocytes it is known as acute myelogenous leukemia (AML). Then, specific type of acute leukemia must be classified in order to provide the best treatment and most accurate prognosis [2]. The original classification scheme proposed by the French-American-British (FAB) Cooperative Group divides AML into 8 subtypes (M0 to M7) and ALL into 3 subtypes (L1 to L3). The FAB classifications of ALL (L1 to L3) which are differentiated based on morphology, including cell size, prominence of nucleoli, and the amount and appearance of cytoplasm [3]. According to French-American-British (FAB) classification also, the description of cells is small and uniform for ALL-L1. Meanwhile, cells of AML-M1 are large and regular [3]. Knowing the subtypes and classification of acute leukemia helps in predicting the clinical behavior of the disease and the prognosis, and in making treatment recommendations [4]. For the diagnosis of leukemia in laboratories, hematologists or technologists analyze human blood by microscope investigation. Unfortunately, the analysis made by human experts (refer to medical persons) is not rapid and it presents a not standardized accuracy due to the operator's capabilities and tiredness [4]. To improve the reliability of the diagnosis and decreasing the dependence on human experts, the computer based digital image processing system was introduced for investigating and classifying acute leukemia diseases. The success of computer aided classification of acute leukemia depends on the correct segmentation of images.

Many segmentation methods for blood cell images have been proposed. The common segmentation methods are edge and border detection, region growing, filtering, mathematical morphology, and clustering algorithm [5]. K-means clustering is one of a popular clustering technique, which is used to classify the pixels into clusters based on their intensity values [5]. As a result of the ability k-means clustering technique, this study proposed combination of saturation formula of HSI color space, k-means algorithm and 7x7 pixels median filter to segment automatically the acute leukemia blood cells from its background and unwanted noise. Furthermore, seeded region growing area extraction (SRGAE) algorithm [6] was utilized to extract the area of blasts from the acute leukemia blood cells images. The proposed segmentation technique reveal the features of AML or

ALL blood slide images such as shape and cells size. This information is important to distinguish either the images are AML or ALL for further analysis by hematologists.

METHODOLOGY

The research methodology involves the following key tasks:

a. Image Acquisition

The acute leukemia blood slide images were analyzed using Leica microscope at 40 magnifications. Then, Infinity 2 camera was used to capture images with 800x600 resolutions, 24-bit color image and saved into bitmap (.bmp) format.

b. Threshold selection method

The segmentation process consists of two parts which is saturation component base on HSI color space and *k*-means algorithm;

Saturation base on HSI color space

In [7] color image segmentation conducted using RGB information of the acute leukemia blood cells image. However, the segmentation using manual RGB pixels threshold value did not perform well, due to inconsistency of color in the images. The threshold value has been selected depending on the changes of intensity in the acute leukemia blood cells image. Basically, the reasons are subject to the preparation of staining procedure (operator dependent) and blood concentrations of individual. Therefore, another approach of segmentation using HSI color space has been considered to reduce this problem. In general, the HSI color space consists of three components Hue, Saturation and Intensity. The saturation component measures the degree of white light added to pure color. Based on observation of blood cells image, the acute leukemia cells (blast) are the most highlighted and clearly be seen in saturation component image. In the mean time, the red blood cells and other particles become less saturated in the saturation component image. Therefore, the saturation component was chosen in order to reduce the computational effort and to ease the clustering process. The saturation formula has been applied to the original acute leukemia blood slide images as in (1).

$$Sat = 1 - \frac{3}{R+G+B}\min(R, G, B) \qquad (1)$$

K- means clustering

After the saturation formula has been applied, the *k*-means clustering process is performed. Each pixel in the image will be automatically segmented into three clusters whose intensity is similar within each cluster. The *k*- means clustering can be implemented as follows to the saturation component images,

1. Select randomly *n* points into the space represented by the pixels that are being clustered. These points represent initial cluster center C_j, where j=1, 2, 3…,*n*.
2. For each pixel, x_{in} of an image, calculate the Euclidean distance, d

$$d = \|x_{in} - c_j\|^2$$

3. Assign each pixel to the cluster that has the nearest center.
4. When all pixels have been assigned, recalculate the positions of the ***n*** centers.
5. Repeat Steps 2 and 4 until the centers no longer move.

c. Removing the background and unwanted noise

The 7x7 pixels median filter was further applied to the segmented images in order to remove unwanted noise. This process yields better and more acute leukemia blood cells image visualization.

d. Area Extraction of acute leukemia blood cells images

From the Figure 1, the area for the region of interest (ROI[k]) is calculated as a total number of pixels in *k*- th region and given by the following (2).

$$Area[k] = Total\ of\ pixels\ in\ ROI[k] \qquad (2)$$

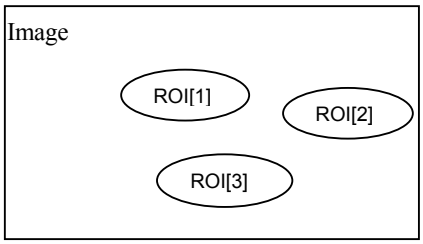


Figure 1: The region of interest (ROI) for area extraction process.

After the backgrounds or unwanted noise have been removed the SRGAE algorithm can be implemented as follows:

i. Initialize Area[k] = 0. Set the value k = 0 (where, k is the number of current ROI).
ii. Search for seed with intensity of pixel value. If the seed is found, increase k to k + 1 and area[k] = 1; else go to step vii.
iii. Search for the neighbor 8 surrounding pixels, grow if found the intensity of pixel value.
iv. Increase area[k] = area[k] + 1 for each pixel that satisfies the growing condition.
v. Grow from the neighbor pixels in step 4 and increase area[k] = area[k] + 1 for each pixel that satisfies the growing condition, repeat until the region cannot be grown or all the pixels have been considered.
vi. Search for new seed which is not belongs to the previous ROI(s).
vii. If the seed is found, increase k to k + 1 and area

[k+1] = 1, go to step iii. Else go to step viii.

viii. End

RESULTS AND DISCUSSION

The proposed method was applied on 60 images of acute lymphoid leukemia (ALL) and acute myeloid leukemia (AML), which were taken from 6 slides of acute leukemia blood samples. Figures 2(a) and 3(a) show the original captured acute leukemia images with resolution of 800x600. Meanwhile, Figures 2(b) and 3(b) show, the images after applying the saturation formula. The results obtained in Figures 2(b) and 3(b) show that the proposed method by beginning with applying the saturation formula to ALL and AML original images to ease the clustering process. From the results shown in Figures 2(c) for ALL images, as well as Figures 3(c) for AML images, it can be noticed that *k*-means clustering algorithm can cluster the region of interest for the acute leukemia blood cell images to 3 regions which are background, nucleus and cytoplasm. From the Figure 2(d) and 3(d), 7x7 pixels median filter was applied to resultant image produced by the *k*-means algorithm to give better results. Figures 2(f) and 3(f) show the location of blast areas resulted from applying using SRGAE algorithm for two samples called ALL and AML respectively. For the segmented images in Figure 2(e) for ALL type, the blasts area appears to be relatively smaller and uniform. Meanwhile, for the segmented AML image, in Figure 3(e) the blasts area appears to be relatively larger and regular. Table 1 and Table 2 show the results of blasts area of ALL and AML images using SRGAE algorithm. Table 1 (ALL type) and Table 2(AML type) show that SRGAE algorithm yields difference area range value for AML and ALL. The range for ALL area of the blasts is from 1200 to 2300 pixels. Meanwhile, range for AML area is from 3500 to 5500 pixels. With reference to Figures 2(e) and 3(e) it can be observed that the method proposed with SRGAE algorithm has a high ability to extract the area of the blasts from acute leukemia images that closely represents the blasts in the original images.

Table 1: Results of blast area of ALL

Type (ALL) Type (ALL) Type (ALL)	AREA(pixels)
B1	**1702**
B2	**1420**
B3	**1510**
B4	**1422**
B5	**1972**
B6	**1180**
B7	**1569**
B8	**2215**
B9	**1264**

Table 2: Results of blast area of AML

Type (AML)	AREA(pixels)
B1	**5388**
B2	**3513**
B3	**3850**
B4	**4241**
B5	**4143**
B6	**4820**
B7	**5261**

CONCLUSIONS

The current study proposed segmentation technique consists of saturation component base on HSI color space, *k*-means clustering and 7x7 pixels median filter procedures. Besides that, this combination with SRGAE also has successfully calculated the area of blast (abnormal white blood cell) in acute leukemia blood slide images. The saturation component was chosen as an input features for the k-means clustering. 7x7 pixels median filter were further applied in order to eliminate the background areas and remove unwanted noise. The advantage of the proposed method is that the selection of the threshold for segmentation is done automatically. Furthermore, the acute leukemia cells in the blood slide image are successfully segmented from its background and unwanted noise. The location of blast is successfully detected. Meanwhile, the area and shape for blast of acute leukemia have also been closely preserved. For the future work, the result of this paper can be used as the basis for extracting the other features from the acute blood slide images. However, to establish the capability and reliability of the proposed method more leukemia blood sample slides should be taken for further testing.

AKNOWLEDGMENT

We would like to express our thanks to UniMAP and Malaysian Government for supporting this research in term of research grant. This research is funded under Fundamental Research Grant Scheme (Grant No. 9003 00129).

REFERENCES

[1] F.Sadeghian, Z.Seman, A.R.Ramli, B.H.Abdul-Kahar and M-I.Saripan," A Framework for White Blood Cell Segmentation in Microscopic Blood Images Using Digital Image Processing",*In Journal Biological Procedures Online*,2009,pp. 196-206.

[2] G. C. C. Lim, "Overview of Cancer in Malaysia" ,*In Japanese Journal of Clinical Oncology*, Department of Radiotherapy and Oncology, Hospital Kuala Lumpur, 2002.

[3] P. Mittal & K. R .Meehan,"The Acute Leukemia", *In Clinical Review Article*, Hospital Physician, 2001,pp.37-44.

[4] I. Panovska-Stavridis, L. Cevreska, S. Trajkova, L. Hadzi-Pecova, D. Trajkov, A. Petlichkovski, O. Efinska-Mladenovska, O. Sibinovska, N. Matevska,

A. Dimovski & M.Spiroski“, Preliminary Results of Introducing the Method Multiparameter Flow Cytometry in Patients with Acute Leukemia in the Republic of Macedonia”, *Maced J Med Sci*. 2008, pp.36-43.

[5] C. W. Chen, J. Luo, and K. J. Parker, "Image Segmentation via Adaptive–Mean Clustering and Knowledge-Based Morphological Operations with Biomedical Applications", *In IEEE Transactions on Image Processing*, 1998,pp. 1673-1683.

[6] N.H. Harun, M.Y. Mashor, R.Hassan,”Calculation of Blast Area for Acute Leukemia Blood Cell Images”, *Paper submitted and accepted at IPCE 2010*,UNiMAP,Perlis,2010.

[7] N.H.Harun, M.Y. Mashor, N.R. Mokhtar, A. S.Abdul-Nasir,R.Hassan,R.A.A.Raof,M.K.Osman, ”Comparison of Acute Leukemia using HSI and RGB color space*” In 10th International Conference on Information Science, Signal Processing and their Applications (ISSPA 2010)*,2010,pp. 740-752.

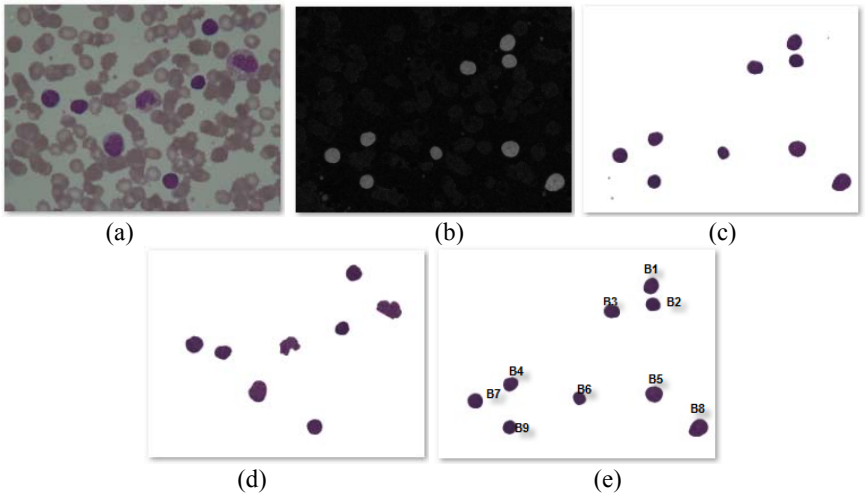


Figure 2.Resulted images for ALL using the proposed method (a) original image (b) saturation component image (c) *k* -means clustering resulted image (d) median filter resulted image (e) segmented blast with label

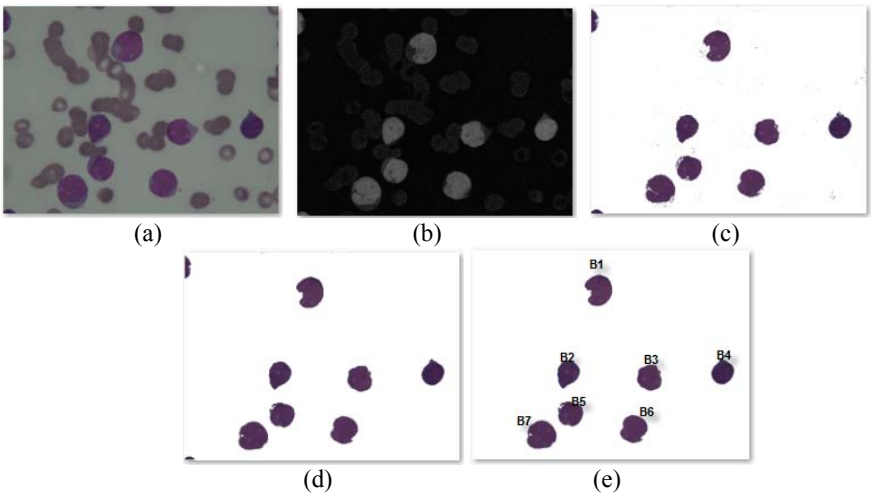


Figure 3. Resulted images for AML using the proposed method (a) original image (b) saturation component image (c) *k* -means clustering resulted image (d) median filter resulted image (e) segmented blast with label

Adaptive Neuro-Controller for Satellite Attitude Control

S.M. Sharun[1], M.Y.Mashor[1], W. N. Hadani[2], M.N. Norhayati[1], S. Yaacob[1]
[1]School of Mechatronic Engineering, Universiti Malaysia Perlis,
Kampus Ulu Pauh, 02600 Ulu Pauh, Perlis.
Tel: 04-9885168, Fax : 04-9885167 E-mail : siti_mrym@ymail.com

[2]Institute of Engineering Mathematic
Universiti Malaysia Perlis, 02000 Kuala Perlis, Perlis.
Tel : 04-9851323, Fax : 04-9855432

Abstract
An intelligence controller namely Adaptive Neuro-controller (ANC) based on Hybrid Multilayered Perceptron (HMLP) network is developed to control the satellite attitude control of a nano-satellite. The neural network is using Model Reference Adaptive System (MRAS) as a control scheme. Weighted Recursive Least Square (WRLS) algorithm has been used to adjust the controller parameters to minimize the error between the plant output and the model reference output. The convergence rate of the ANC is further improved by using WRLS as the training algorithm. In this current study, the advantages of HMLP network and the WRLS algorithm are combined to improve the performance of tracking control technique and time response in varying operating conditions such as noise, varying gain and disturbance torques. The performance of the ANC was compared to the other ANC based on standard MLP network. These controllers have been tested using a nano-satellite plant. The simulation results indicated that ANC based on HMLP network gave significant improvement over ANC based on standard MLP network.

Keywords
Adaptive Neuro-controller, Hybrid Multilayered Perceptron, Model Reference Adaptive System, Weighted Recursive Least Square.

INTRODUCTION

One of the most important issues in satellite control design is the attitude stabilization and control, which is the combination of mathematics, dynamics, and control theories. The attitude motion of the satellite is modeled by the Euler equations for the motion of a rigid body under the influence of external moments. The total external moment acting on the body is equal to the inertial momentum change of the system. External moments are the combination of aerodynamics effect, solar pressure and gravity gradient forces, magnetic torques, and reaction torques produced by particles expelled from the body [1-2].

Intelligent controllers could be utilized to overcome the problem of satellite attitude control. As a result, numerous intelligent controllers have been proposed to replace the traditional ones [3].

For satellite attitude control system, a few approaches by using neural network have been developed [4-7]. Mehrabian [8] proposed a model reference adaptive neuro-controller using feed-forward neural network with momentum back-propagation learning algorithm. This controller was utilized to control a nonlinear system. However, it needs some tuning of parameters requiring a few trails and error to be properly selected. Rajasekaran [9] developed a structured model-following Neuro Adaptive control. From simulation studies, this adaptive controller is found to be very effective in executing precise large attitude maneuvers in the presence of uncertainties and constant disturbances. However, some of the other practical issues such as sensitivity to noise, actuator time delays, time varying disturbance torques and robustness to un-modeled dynamics have not being addressed in the paper.

SATELLITE MODEL

One of an effective and simplified model to represent a satellite system in space is a double integrator model which having two poles at the origin of s-plane. This model is considered to present the tumbling behavior of a satellite in space after deployment and used to study the performance aspects of satellite behavior under various conditions. This continuous model is reasonable to be assumed of having an input sampler with a Zero Order Hold (ZOH) and an Analog Digital Converter at its output so that a digital computer control is possible [10].

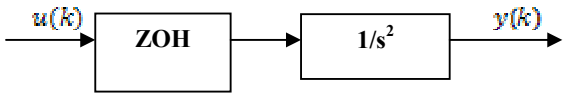


Figure 1: The discrete model

Figure 1 describes a discrete model to be used in the simulation study and the discrete form of double integrator model of the satellite is writing as:

$$y(k) = 2y(k-1) - y(k-2) + 0.5 * [u(k-1) + u(k-2)] \quad (1)$$

where $u(k)$ is the controller output and $y(k)$ is the actual angle oriented by the satellite

CONTROL STRUCTURE OF ADAPTIVE NEURO-CONTROLLER

Model Reference Adaptive System

In model reference adaptive system (MRAS), a reference model is chosen to generate the desired output trajectory. The main task of MRAS is to ensure the output of the controlled system to follow the output of the reference model, in addition to closed-loop stability. A typical model reference adaptive control system as shown in Figure 2 [11], consists of a plant (with unknown parameters) to be controlled.

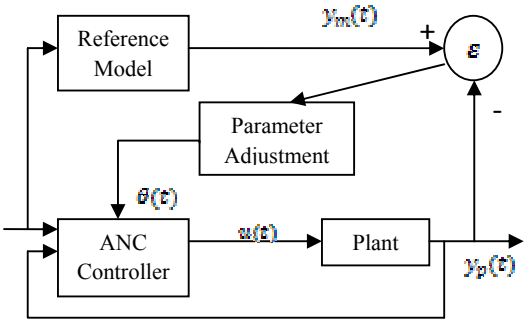


Figure 2: Model Reference Adaptive System

The adjustment mechanism, which is an on-line least square family algorithm, will be used to adjust the ANC parameters to minimize the error between the plant output and the model reference output. The stable linear continuous-time reference model is specified by the following differential equation [11]:

$$y_m(t) = a_{m_1} y_m(t-1) - a_{m_2} y_m(t-2) + b_{m_1} r(t-1) + b_{m_2} r(t-2) \quad (2)$$

where $r(t)$ is reference input and $y_m(t)$ is reference model output; a and b are fixed model parameters and their values are chosen for any desired stable response, which the process system is expected to acquire.

Hybrid Multi Layered Perceptron network

In this current study, Hybrid Multi Layered Perceptron (HMLP) network that has been proposed by Mashor [12], was selected as the basis for the ANC. A HMLP network with one hidden layer is shown in Figure 3. The network allows the inputs to be connected directly to the output nodes via some weighted connections to form a linear model in parallel with the nonlinear original MLP model. These additional linear input connections do not significantly increase the complexity of the MLP network since the connections are linear. It has been proved that HLMP network only requires very small number of neurons to perform the control action.

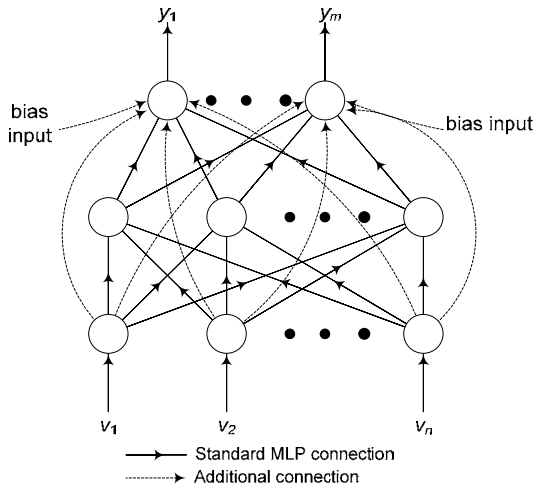


Figure 3: Hybrid Multi Layered Perceptron Network

The HMLP network with one hidden layer can be expressed by the following equation:

$$\hat{y}_k(t) = \sum_{j=1}^{n_h} w_{jk}^2 F\left(\sum_{i=1}^{n_i} w_{ij}^1 v_i^0(t) + b_j^1\right) + \sum_{i=0}^{n_i} w_{ik}^l v_i^0(t) \quad (3)$$

for $1 \le k \le m$, where w_{ij}^1, w_{jk}^2 and w_{ik}^l denote the weights in the first layer, weights in the second layer and weights of extra linear connections between the input and output layer, respectively; b_j^1 and v_i^0 denote to the thresholds in the hidden nodes and inputs that are supplied to the input layer respectively. The number of output node, inputs nodes and hidden nodes are represented by m, n_i and n_h respectively. $F(\cdot)$ is an activation function that is normally selected as a sigmoid function:

$$F(v(t)) = \frac{1}{1+e^{-v(t)}} \quad (4)$$

The weight w_{ij}^1, w_{jk}^2 and w_{ik}^l and threshold, b_j^1 are unknowns and should be selected to minimize the prediction error, define as:

$$\epsilon_k(t) = y_k(t) - \hat{y}_k(t) \quad (5)$$

where $y_k(t)$ and $\hat{y}_k(t)$ are the actual and the network output.

Estimation Algorithm

A Weighted Recursive Least Square (WRLS) algorithm has been used as an estimation algorithm that will adjust the ANC parameters to minimize the error between the plant output and the model reference output. For all $t \ge t_0$, given $\hat{\theta}(t_0)$ and set $P(t) = \alpha[I]$, the WRLS estimate $\hat{\theta}(t_0)$ using the following recursive equations [13]:

$$\vec{\theta}(t) = \vec{\vartheta}(t-1) - K(t)\left[y(t) - \varphi^T \vec{\theta}(t-1)\right] \quad (6)$$

$$K(t) = P(t-1)\varphi(t)\left[\lambda I + \varphi^T P(t-1)\varphi(t)\right]^{-1} \quad (7)$$

$$P(t) = \left[I - K(t)\varphi^T(t)\right] P(t-1)/\lambda \quad (8)$$

Mashor [11] modified Equation (6) according to:

$$\hat{\theta}(t) = \hat{\theta}(t-1) + K(t)e(t-1) \quad (9)$$

where e is the difference between plant output and reference input and $\varphi(t)$ is the information vector that consists of the controller inputs. $\hat{\theta}(t)$ is the vector of controller parameters, $P(t)$ is covariant matrix and $\lambda(t)$ is forgetting factor. Other symbols are defined and assigned according to the standard WRLS algorithm [13].

RESULT AND DISCUSSIONS

The performance of the ANC based on HMLP network is compared to the ANC based on standard MLP network. Both controllers used WRLS algorithm as a mechanism to adjust the controller parameters in a model reference adaptive control scheme. In this comparison, HMLP will have extra weights if the same number of input, hidden and output nodes is used. For HMLP network the number of weight is given by:

$$n_w = n_i \times n_h + n_h + n_i \quad (10)$$

whereas for MLP network, the number of weight is:

$$n_w = n_i \times n_h + n_h \quad (11)$$

To be fair for this ANCs comparison, the MLP network with one extra hidden node is also considered. Therefore, HMLP network will be assigned to have 3 hidden nodes whereas MLP network with 4 hidden nodes is also considered for comparison. So that, HMLP network with 3 hidden nodes (HMLP3) will have 35 weights, MLP network with 3 hidden nodes (MLP3) will have 27 weights and MLP with 4 hidden nodes (MLP4) will have 36 weights. Thus, in this ANCs comparison the MLP network with 4 hidden nodes will have one extra weight over the HMLP network with 3 hidden nodes.

Performances of these ANC controllers are computed and compared in Table 1 to 3. Figure 4 shows a good result for the HMLP controller output, where the overshoot only 9.89% compares to the other MLP controllers that is 66.20% and 54.88%. Figure 5 also shows that the output response of HMLP can track smoothly the model reference even at low gain. Figure 6 shows the system is subjected to measurement noise. All the ANC controllers can follow the reference model response very well despite of the significant noise but overshoot for MLP controllers is still high. Figure 7 shows the response of the system when a step disturbance with strength of 20% was introduced between 300s and 600s. Output response from HMLP controller is better than output response from the MLP controllers because the response can converge in a short time after disturbance. From the Table 1 to 3, it also can be observed that performance of the HMLP controller is better than the both MLP controllers in terms of percentage of overshoot, rise time and settling time.

Table 1: The analysis of ANC output for constant gain, K=1

Results	MLP3	MLP4	HMLP
Rise Time (Tr)	10.34s	8.07s	4.78s
Settling Time (Ts)	71.92s	109.95s	54.38s
Overshoot (%)	66.20%	54.88%	9.89%

Table 2: The analysis of ANC output for varying gain

Results	MLP3	MLP4	HMLP
Rise Time	10.21s	7.99s	4.76s
Settling Time	74.82s	103.33s	44.86s
Overshoot (%)	64.65%	52.44%	8.63%

Table 3: The analysis of ANC output for step disturbance

Results	MLP3	MLP4	HMLP
Rise Time	10.35s	8.06s	4.78s
Settling Time	104.2s	Not settle	117.50s
Settling Time after beginning of disturbance	Not settle	Not settle	444.50s
Settling Time after ending of disturbance	860.50s	734.70s	720.60s
Overshoot (%)	101.3%	66%	6%
Deviation at beginning of disturbance (%)	620%	280%	92%
Deviation at ending of disturbance (%)	135%	130%	72%

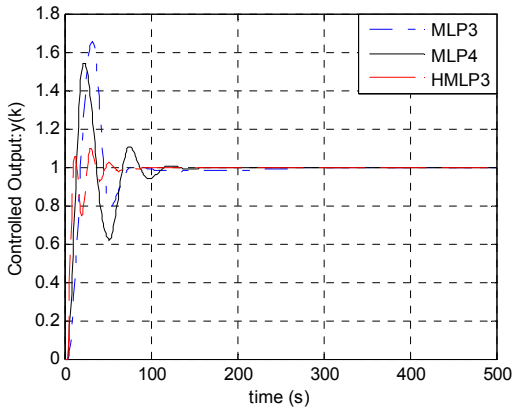


Figure 4: Output response of ANC with constant gain

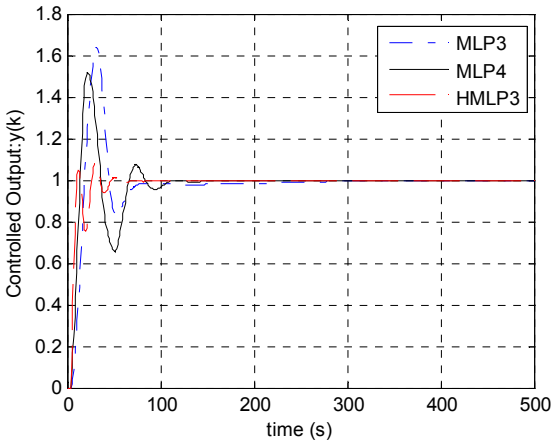


Figure 5: Output response of ANC with varying gain

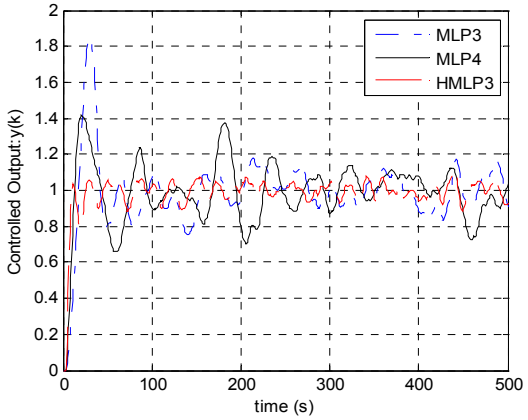


Figure 6: Outputs response of ANC with additive noise

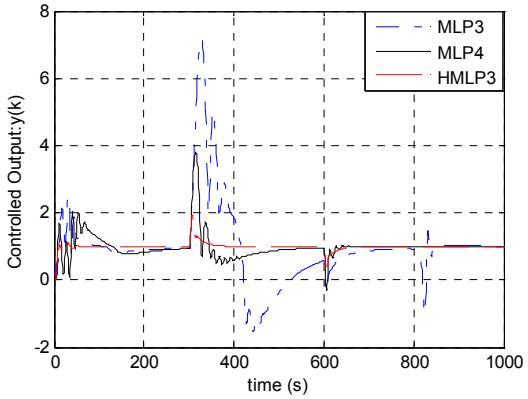


Figure 7: Output response of ANC with step disturbance

CONCLUSIONS

The simulation results signify that the proposed control scheme is sufficient to control the plants with unpredictable conditions. It is observed that ANC HMLP network is controllable and more stable than ANC standard MLP network. In fact, the ANC HMLP network can give better performance than the ANC standard MLP network with more hidden nodes. The directions for future investigation will be oriented at the robustness issues of the neural network-based adaptive control structures, and applications of the control scheme to the real plants.

REFERENCE

[1] A. Gonzalez and R. Ordonez, "Adaptive Control Scheme for Plants with Time-Varying Structure Using On-Line Parameter Estimation", in *IEEE Conference on Discussion and Control*, Barcelona, Dec 2005.

[2] H.A. Talebi and R.V. Patel, "Neural Network-Based Fault Detection Scheme for Satellite Attitude Control Systems", *Proceedings of the 2005 IEEE Conference on Control Applications,* Toronto, Canada, August, 2005.

[3] H. Y. Hao, Z. Sun and Y. Zhang, "Fault Diagnosis on Satellite Attitude Control with Dynamic Neural Network", *State Key Lab of Intelligent Technology and Systems*, Dept. of Computer Science & Technology, Tsinghua University.

[4] K. KrishnaKumar, S. Rickard and S. Bartholomew, "Adaptive neuro-control for spacecraft attitude control", *Journal Neuro-computing*, pp. 131-148, 1995.

[5] N. Sivaprakash and J. Shanmugam, "Neural Network Based Three Axis Satellite Attitude Control Using Only Magnetic Torquers", *24th Digital Avionics Systems Conference,* October 30, 2005.

[6] A. R. Mehrabian and M. B. Menhaj, "A real-time neuro-adaptive controller with guaranteed stability", *Applied Soft Computing*, vol. 8, pp. 530-542, 2008.

[7] J. Rajasekaran, A. Chunodkar, and R. Padhi, "Structured model-following neuro-adaptive design for attitude maneuver of rigid bodies", *Control Engineering Practice*, vol. 17, pp. 676-689, 2009.

[8] R. Nagarajan, M. P. Paulraj, S. Yaacob, Z. M. Zain, W. S. K. Hoh, A. S. Arshad, "PID and Adaptive Predictive Fuzzy Logic Controller for a Micro-satellite", *International Conference on Electronic Design*, December 1-3, 2008, Penang.

[9] M. J. Sidi, *Spacecraft Dynamics and Control,* Cambridge University Press, 2001.

[10] J. R. Wertz, Ed., *Spacecraft Attitude Determination and Control*, Holland: Kluwer Academic Publishers, 1978.

[11] M.Y. Mashor, "Indirect Model Reference Parametric Adaptive Controller", *International Conference on Control, Instrumentation and Mechatronics Engineering,* Johor Bahru, Malaysia, May 2007.

[12] M. Y. Mashor, "Hybrid Multilayered Perceptron Network", *International Journal Of System Science*, vol. 31, pp. 771-785, 2000.

[13] K.J. Astrom and B. Wittenmark, *Adaptive Control, 2nd Ed*., Addison Wesley Longman, 1995.

Emotion-Sensitive Robot: an Implementation using GPSO Algorithm

Bashir Mohammed Ghandi, R. Nagarajan and Hazry Desa
School of Mechatronic Engineering, Universiti Malaysia Perlis (UniMAP)
Ulu Pauh, 02600 Arau, Perlis, Malaysia
bmghandi@gmail.com, {nagarajan, hazry}@unimap.edu.my

Abstract

Nowadays, emotion recognition is receiving a great deal of attention from researchers in both the academia and the industries due to its application potentials in many areas. One such application is in developing an emotion-sensitive robot that could be used in assisting highly disabled or elderly people who may be confined to their homes due to illness or old age, with virtually no one around to look after them. In this paper, we present our first attempt at developing such a robot. The robot is controlled by an expert system that we developed, which receives input from a wireless video camera mounted on the robot. It analyzes the video stream and detects the emotions expressed in real-time, and then instructs the robot to perform some pre-programmed actions depending on the detected emotion. The expert system itself was implemented using the Guided Particle Swarm Optimization (GPSO) algorithm which we earlier developed and shown to have a very good recognition success rate. Our results show that the robot responds appropriately in real-time, proving that in addition to having good recognition rates, our expert system is also efficient enough to be applied in real-life.

INTRODUCTION

In human face-to-face interaction, one can naturally perceive the emotion of a fellow human communication partner and adjust the dialogue accordingly. However, human-computer interaction is so far an emotionless exercise in which the computer has no idea about the feelings of its user. In order to improve on this rather unnatural way of communication, researchers in the fields of Artificial Intelligence, Human-Computer Interaction, Computer vision and other related fields, have been working towards devising a computer system that can recognize the emotion of its human user. The success of such research efforts could result not only in changing the way that humans interact with computers and other computer-animated agents such as robots, but could also create new useful computer and robotic applications. For example, a social welfare robot could be developed to monitor and assist elderly people as well as highly disabled patients where there are limited human nurses.

Previously, we implemented an expert system for facial emotion recognition based on the Guided Particle Swarm Optimization (GPSO) algorithm which we earlier developed. We successfully tested the system and obtained very good recognition success rates as published in [1] and [2]. However, in our previous experiments, the input video stream of the subject's face was obtained from a fixed and stable camera attached to the computer on which the system runs, with the subject made to face the camera. Moreover, the output of the system was a simple screen display indicating the recognized emotion. In this paper, we present the results obtained by experimenting the system using a humanoid robot. The humanoid robot, Fig. 1, was constructed using the Robotis Bioloid comprehensive robot kit, consisting of CM-5 microcontroller, 18 AX-12+ servo motors, one AX-S1 sensor module and a wireless video camera.

Fig. 1 Humanoid Robot mounted with a wireless video camera and integrated with the emotion recognition expert systems.

In this experiment, the input video stream of the subject's face is obtained from the wireless camera mounted on the head of the humanoid robot. The robot was programmed to perform different actions for each of the six basic emotions. However, the expert system was still executed on a PC due to the limited memory on the CM-5 microcontroller of the robot. Communication was achieved between the Robot and the Expert system running on a PC using a Zig-bee wireless personal area network. The results

obtained show very good emotion recognition success rate despite the fact that the camera is now mounted on a moving object (the robot).
The rest of the paper is organized as follows: First we discuss emotion detection, where we identified some of the methods that the earlier researchers have used in tackling the emotion detection problem and then explained our own approach. Next, we briefly introduced the three main underlying algorithms that our system rests upon, namely, PSO, GPSO, and Lucas-Kanade optical flow algorithm. This is followed by a discussion on the experimental set-up. There we explained about the humanoid robot, the actions it performs on detecting an emotion and how it communicates with the expert system. We then presented and discussed our results and identified future research work that is yet to be done. Finally, in the last section we presented our conclusions.

EMOTION DETECTION

Different methods have been used by researchers in their efforts to device a system that can detect human facial emotions. The Facial Action Coding System (FACS) [3] is the best known and the most commonly used system developed for human observers to describe facial activity in terms of visually observable facial muscle actions (i.e., Action Units, AUs). With FACS, human observers can uniquely decompose a facial expression into a subset of the 44 AUs that produced the expression in question [4]. Recent work on facial AU detection applying biologically inspired algorithms has used ANNs [5], SVMs [6], [7], and Bayesian Networks [8]. A good survey of past work in the field was presented in [9].

Our methodology is based on studying the underlying AUs that are involved in expressing the different types of emotions. The AUs are specified at run-time on the face of the subject in a running video stream by simple mouse clicks. Lucas-Kanade optical flow algorithm [10], discussed in section III (C), is then used to automatically keep track of the positions of the AUs from frame to frame in an array. It is this array that we use as input for analyzing the emotion being expressed in each particular frame in the video stream using the GPSO algorithm discussed in section III (B). Our system instantly displays the identified emotion on the screen on a continuous basis as the positions of the AUs are analyzed in each frame as shown in Fig. 2. In addition to the GUI output display, the system also instructs the humanoid robot to perform a corresponding pre-programmed action for each detected emotion.

PSO, GPSO AND LUCAS-KANADE ALGORITHMS

In this section, we briefly discuss the basic algorithms that our emotion recognition system rests open, namely, the Particle Swarm Optimization (PSO) algorithm, The Guided Particle Sawrm (GPSO) algorithm, which is our own modification to PSO designed for emotion recognition and Lucas-Kanade optical flow algorithm, which is used to track the run-time positions of the AUs.

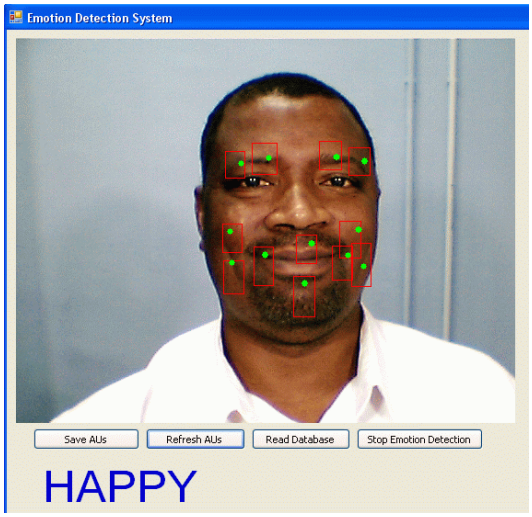


Fig. 2: The happy emotion identified by the system.

Particle Swarm Optimization (PSO)Algorithm

PSO is a population-based search algorithm initially designed to simulate the social behavior of birds in a flock as they fly in search of food [11]. A PSO algorithm maintains a swarm of particles, where each particle represents a potential solution [12]. Particles are "flown" through a multi-dimensional search space, where the position of a particle is adjusted according to two factors:

- Its own successful experience
- The successful experiences of its neighbors.

Let $x_i(t)$ denote the position of particle i at time t. The position of the particle is changed by adding a velocity, $v_i(t+1)$ to the current position.

$$x_i(t+1) = x_i(t) + v_i(t+1) \quad (1)$$

where $x_i(0)$ is generated randomly from $[x_{min}, x_{max}]$.
It is the velocity vector that drives the optimization process, and reflects both the experience of the particle and the experiences of its neighbors. The experiential knowledge of the particle is referred to as the *cognitive* component, and is proportional to the distance of the particle from its own best position [12]. The socially exchanged information is referred to as the *social* component of the velocity equation. Originally, two PSO algorithms were developed, which differ in the size of their neighborhoods. These two algorithms are known as the global best PSO *(gbest)* and the local best PSO (*lbest*) [12].

For *gbest*, the neighborhood for each particle is the entire swarm. The social networking employed by

*gbes*t reflects the star topology, where the social component of the velocity equation reflects the information obtained from the entire swarm [12]. In this case, the social component is the best position found by the swarm, represented as ŷ(t). Thus, for *gbest*, the velocity of particle i is calculated as in (2).

$$v_i(t+1) = v_i(t) + c_1 r_1(t)[y_i(t) - x_i(t)] + c_2 r_2(t)[\hat{y}(t) - x_i(t)] \quad (2)$$

where, $v_i(t)$ is the velocity of particle i in a given dimension at time t. $x_i(t)$ is the position of particle i in a given dimension at time t. c_1 and c_2 are positive acceleration constants. $r_1(t)$ and $r_2(t)$ are random values in the range [0, 1], generated at time t and $y_i(t)$ is the best position so far found by particle i.

For minimization problem, the personal best at the next time step, t+1, is calculated as:

$$y_i(t+1) = \begin{cases} y_i(t) & \text{if } f(x_i(t+1)) \geq f(y_i(t)) \\ x_i(t+1) & \text{if } f(x_i(t+1)) < f(y_i(t)) \end{cases} \quad (3)$$

where $f : \mathrm{R}^n \longrightarrow \mathrm{R}$ is the fitness (or objective) function, which measures how close the corresponding solution is to the optimun. Fig. 3. Summarizes the *gbest* PSO algorithm.

```
Create and initialize an n – dimensional swarm;
repeat
for each particle i = 1, . . ., n do
        //set the personal best position
        if f(xi) < f(yi) then
                yi = xi;
        end
        // set the global best position
        if f(yi) < f(ŷ) then
                ŷ = yi;
        end
end
for each particle i = 1, ..., n do
        update the velocity using equation (2);
        update the position using equation (1);
end
until stopping condition is true
```

Fig. 3. PSO (Global best) algorithm.

The local best PSO, *lbest*, is similar to the *gbest,* except that it uses a ring social network topology, where smaller neighborhoods are defined for each particle [12].

Details of PSO and its variations are given in [12].

Guided Particle Swarm Optimization (GPSO)

The emotion detection problem is a search problem, where at each stage, we are searching to identify which of the possible emotions does the current facial expression represents. Thus, clearly emotion detection lends itself as a possible candidate for PSO application. However, in order to apply PSO to solve the emotion detection problem, we need to first define the various parameters of the algorithm in relation to the problem. In particular, we need to define the following:

- What is the search space and its dimension?
- How do we represent a particle in the emotion-detection setting?
- How do we represent the position and velocity of a particle?
- What is the objective function to be minimized by the PSO?

We answered all the above questions and gave a detail modified algorithm, which we named GPSO in [1]

Lucas-Kanade Optical Flow Algorithm

Optical flow is the pattern motion of objects in a visual scene caused by the relative motion between an observer and the scene. Thus, given a sequence of frames describing a moving visual scene, the goal of optical flow is to find for each pixel in a frame, a velocity vector (u, v) which describes:

- how quickly the pixel is moving from one frame to the next
- in which direction the pixel is moving.

A method of computing the optical flow was developed by Lucas and Kanade in 1981 [10]. The algorithm came to be known as Lucas-Kanade or LK algorithm. The basic idea of the LK algorithm rests on three assumptions as listed below:

1. *Brightness constancy*. A pixel does not change in Intensity (or color) as it moves from frame to frame.
2. *Temporal persistence or "small movements"*. The image motion of a surface patch changes slowly in time. This means the temporal increments are fast enough relative to the scale of motion in the image that the object does not move much from frame to frame.
3. *Spatial coherence.* Neighboring points in a scene belonging to the same surface, have similar motion, and project to nearby points on the image plane [13].

These three assumptions were used to derive the LK algorithm as detailed in [13]. LK algorithm was implemented as a function in OpevCV library and our system simply makes use of this library function to keep track of the AUs in each iteration of the GPSO algorithm.

EXPERIMENTAL SET-UP

As briefly mentioned in the introduction, the emotion recognition system used in this experiment consists of two main components. The first component is the emotion recognition expert system, which is a software implemented based on the GPSO algorithm and programmed using the C# programming language. The expert system is a real-time software that runs on a PC, receiving input video stream of the face of a human subject from any attached video camera and displaying the detected emotion through its GUI on the screen. The details of the expert system was

explained in [2]. In this particular experiment, the expert system was modified to also send the results of the emotion detection to a humanoid robot so that the robot can perform some basic pre-programmed actions depending on the detected emotion.

The communication between the PC and the robot was achieved using Zigbee personal area network (PAN). This involves two ZIG-100 wireless communication modules and a ZigToSerial converter (Fig 4). ZIG-100 is a small module that has a built-in Microcontroller Unit and a Zigbee IC, allowing UART communication using 2.4GHz frequency [14]. One of the ZIG-100 modules is attached to the ZigToSerial converter, which is in turn attached to the serial port of the PC running the expert system software. The other Zig-100 module is attached to the Microcontroller of the Robot.

Fig. 4: pair of ZIG-100 Modules and a ZigToSerial converter used for ZIGBEE wireless communication with the robot

The humanoid robot (Fig. 1), was constructed using the Robotis Bioloid comprehensive robot kit, consisting of CM-5 micro controller, 18 AX-12+ servo motors, one AX-S1 sensor module and a wireless video camera. The robot can be programmed by using the behavior control program that came with the kit as well as using C language [15]. It can perform all basic physical actions expected of a humanoid including picking up things with its hands, walking and dancing. For the purpose of this experiment, the robot was programmed to perform different actions for each of the six basic emotions as follows:

- *Happy*: The robot claps its hand a few times as a show of appreciation that the subject is happy
- *Sad*: The robot performs some acrobatic dance to entertain the subject so that he may be happy again
- *Surprise*: The robot raises its hands in a sudden fashion to show that it is also surprised
- *Disgust*: The robot covers its face with its hands and turns to a different direction to show that it is also disgusted
- *Fear:* The robot changes into fighting mode, using its hands to kick an imaginary enemy in an effort to protect the subject
- *Angry*: The robot bends down a few times as a way of expressing sorry to the subject.

It should be noted that while these robot actions are rather fictional, they serve to demonstrate the fact that a robot can be programmed to perform more useful actions such as bringing water or medicine to a patient, calling the doctor if there is emergency, etc.

RESULTS AND DISCUSSION

The system was tested with 20 different subjects of diverse ethnic backgrounds, age and sex. Each subject was made to face the robot whose wireless video camera transmits live video stream to the expert system running on a PC.

Table 1: Percentage recognition success rates for each of the six basic emotions taken over 20 subjects of different backgrounds

Subjects	Percentage recognition success rates						
	Happy	Sad	Surprise	disgust	angry	fear	Average
1	85	76	90	79	79	72	**80**
2	92	85	97	72	90	76	**85**
3	94	87	98	85	89	80	**89**
4	89	79	90	75	80	74	**81**
5	83	79	89	77	77	81	**81**
6	97	84	100	84	94	84	**91**
7	93	87	99	82	76	76	**86**
8	88	91	94	76	86	82	**86**
9	99	82	96	78	85	77	**86**
10	94	84	94	80	91	79	**87**
11	91	78	98	73	90	74	**84**
12	98	83	87	76	78	71	**82**
13	87	80	90	81	86	79	**84**
14	91	86	96	74	97	76	**87**
15	95	77	97	84	88	81	**87**
16	86	81	91	77	81	73	**82**
17	98	83	100	81	87	75	**87**
18	94	80	99	75	80	74	**84**
19	86	78	92	73	76	71	**79**
20	97	76	100	78	85	80	**86**
Average	**92**	**82**	**95**	**78**	**85**	77	**85**

For each subject, after the relevant Action Units (AUs) were initialized, the subject was asked to express the six different emotions in a random order in the form emotion A, neutral, emotion B, neutral, etc. The experiment was repeated three times for each subject. As the system recognizes and displays the emotion on the screen for each frame of the video stream, it also saves the recognized emotions in a data file. In addition, the system also records the entire session as a video clip. The saved video clips were later used to conduct manual recognition by a human user, where for each frame of a clip, the emotion being expressed by the subject was identified and recorded in another data file. The two data files were then compared. The automatic recognition by the system was considered to be a success only if it matched the manual recognition by the human user. The result of the comparison is shown in Table 1

From Table 1, it can be seen that the average success rate with respect to each emotion ranges from 77 (fear) to 95 (surprise). The average success rate also varies with respect to subjects from 79 (subject # 19) to 91 (subject #6). The overall average success rate was 85. The main points that can be said about these results are summarized below.

- The overall average success rate of 85 is very good given the real-time nature of the system.
- The rate of recognizing the Surprise emotion is high because this emotion has more distinct features than others – both the upper and lower part of the face are involved in expressing the surprise emotion. Other emotions such as sad and disgust have some common features, thus making their recognition relatively harder.
- The variation of the success rates across the subjects is not much (79 to 91), suggesting that the system is able to adapt to different subjects

CONCLUSIONS

In this paper, we have presented the results obtained from integrating the latest version of our emotion recognition expert system with a robot. Although the programmed actions of the robot are fictional in nature, it demonstrates how the system may be deployed in real-life. The results obtained show that the system works very well even though the video camera is now on a moving object – the humanoid robot. A completely autonomous system can be achieved if the micro controller of the robot is replaced with one that has more computing power and more memory so that the system can be embedded onto it, avoiding the need for a PC to run the emotion detection expert system.

REFERENCES

[1] B. M. Ghandi, R. Nagarajan, H. Desa, "Particle Swarm Optimization Algorithm for Facial Emotion Detection", *IEEE Symposium on Industrial Electronics & Applications (ISIEA 2009)*, Kuala Lumpur, Malaysia, 4-6 October 2009, pp 588 - 592.

[2] B. M. Ghandi, R. Nagarajan, H. Desa, *"Facial Emotion Detection using GPSO and Lucas-Kanade Algorithms"*, International Conference on Computer and Communication Engineering (ICCCE 2010), Kuala Lumpur, Malaysia, 2010, pp 859 – 864.

[3] D. Keltner and P. Ekman, "Facial expression of emotion", *Handbook of emotions, M. Lewis and J.M. Haviland-Jones, Eds. Guilford Press, New York*, 2000, pp. 236-249.

[4] M. F. Valstar and M. Pantic. "Biologically vs. Logic Inspired Encoding of Facial Actions and Emotions in Video". *IEEE Inter. Conference on Multimedia and Expo*, 2006, pp. 325--328.

[5] Y. Tian, T. Kanade and J.F. Cohn, "Recognizing action units for facial expression analysis", *IEEE Trans. on Pattern Analysis and Machine Intelligence*, 2001, vol. 23, no. 2, pp. 97-115.

[6] M.S. Bartlett, G. Littlewort, C. Lainscsek, I. Fasel, J. Movellan, "Machine learning methods for fully automatic recognition of facial expressions and actions", *IEEE International Conference on Systems, Man and Cybernetics*, 2004, vol. 1, pp. 592-597

[7] M.F. Valstar, I. Patras and M. Pantic, "Facial Action Unit Detection using Probabilistic Actively Learned Support Vector Machines on Tracked Facial Point Data", *IEEE Computer Society Conference on Computer Vision and Pattern Recognition*, 2005, vol. 3, pp. 76-84.

[8] Y. Zhang and Q. Ji. "Active and Dynamic Information Fusion for Facial Expression Understanding from Image Sequences", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2005, vol. 27, no. 5, pp. 699-714.

[9] M. Pantic and L.J.M. Rothkrantz, "Toward an Affect-Sensitive Multimodal Human-computer Interaction", *Proceedings of the IEEE*, 2003, vol. 91, no. 9, pp. 1370-1390.

[10] B. D. Lucas and T. Kanade, "An iterative image registration technique with an application to stereo vision," in *Proceedings of Imaging Understanding Workshop*, 1981, pp. 121–130.

[11] J. Kennedy, R. Eberhart, "Particle swarm optimization", *Proceedings. of IEEE International Conference on Neural Networks*, Perth, Australia, 1995, pp. 1942-1948.

[12] A. P. Engelbrecht, "Computational Intelligence: An Introduction", Second Edition, New York, NY: Wiley, 2007.

[13] G. Bradski and A. Kaebler, Learning OpenCV: Computer Vision with the OpenCV Library, O'Reilly Media, 2008, pp.322-334.

[14] ZIG-100 User Manual, ROBOTIS, 2007, Seoul Korea, http://www.robotis.com/zbxe/?module=file&act=procFileDownload&file_srl=5456&sid=65ea4371e6042fb1f73f58443d642c10, retrieved on March, 2010, pp: 2,.

[15] Bioloid Expert Manual, 2009 ROBOTIS, Seoul Korea, pp 69-106. http://www.bioloid.info/tiki/tikidownload_file.php ?fileId=87, retrieved on March, 2010.

Development of a Virtual Reality Eye Surgery Simulator

C. K. Lam, K. Sundaraj
School of Mechatronic Engineering, Universiti Malaysia Perlis (UniMAP)
Kampus Ulu Pauh, 02600 Arau, Perlis, Malaysia.
cklam85@gmail.com

Abstract
Eye is playing an important role in human sensory organs to provide sight for human. Ophthalmologists are required to spend hours of training on human dummies and animal eyes before they are eligible to start operating patients. Improvement in the architecture of virtual reality allows surgery simulator to be created as an alternative way for ophthalmologists to sharpen their skills in order to reduce the risk of eye patients when undergoing eye surgery. This paper addresses the system architecture of an eye surgery simulator with the implementation of a force feedback haptic device. The current performance of the eye surgery simulator is reviewed followed by some suggestions for the future work at the end of the paper.

Keywords
Eye surgery simulator, virtual reality, haptic feedback.

INTRODUCTION

Most of the human are born with complete five senses which are sight, hear, taste, smell and touch. Eyes are the sensory organ that detects lights in order to provide vision for human [1]. Ophthalmology generally involves several complex surgical procedures. Junior ophthalmologists are compulsory to undergo several months of training on specific surgical skills before they are permitted to be involved in the actual surgical treatment [2]. This is a very serious task for all of them since any mistake happened during the operation may cause blindness to the patient [3]. There are a lot of researches and inventions have been done so as to increase the success rate of the ophthalmology [4].

The rapid growth of technology on central processing unit (CPU) and graphical processing unit (GPU) is capable to perform realistic visualization on three-dimensional (3D) graphical models that provides a great opportunity for virtual reality (VR) to be implemented into various types of surgery simulators. 3D model of different patients can be generated from MRI scan in order to give precise representation on human physiology for ophthalmologists to plan surgical procedures [5].

The combination of this latest technology with haptic device that provides tactile feedback from collision is capable to develop high fidelity surgery simulator as training platform for ophthalmologists to gain experience and explore less invasive surgical skills [6]. They are able to avoid the preparation of complicated training operation room and undergo their surgical training without time constraints by using surgery simulator [7]. VR surgery simulator also allows ophthalmologist to carry their surgical training at anywhere continually exclusive of any incremental cost.

In this paper, we explained about the development of our VR eye surgery simulator with a force feedback haptic device. The simulator provides selections on the important parts of human eye anatomy and different types of surgical instruments. Graphical user interface (GUI) with various types of controls has been designed in the simulator for users to get familiar with the functions effectively. This paper proceeds with an overview of system architecture in section 2. Section 3 discusses the modelling technique for human eye and surgical instruments. Collision detection and haptic rendering are explained in section 4 and 5 respectively. Results and discussions are addressed in section 6 followed by conclusion and future work in section 7.

SYSTEM ARCHITECTURE

The VR eye surgery simulator operates on a desktop with Intel Core 2 Duo Processor 2.6 GHz. It is equipped with a 2GB DDR-2 RAM and Nvidia GeForce 6600 graphics card which is sufficient to provide smooth haptic rendering and 3D graphics rendering in the surgery simulator. Phantom Omni from SensAble Technologies Inc. [8] is being equipped into the simulator as force feedback haptic device. It is consists of six degrees of freedom in positional sensing and generates three degrees of freedom in force feedback with a maximum of 3.3 Newton [9]. The simulator software is developed by using C++ source code associated with OpenGL libraries and OpenHaptics libraries [10].

The simulator system which consists of several components is illustrated in Figure 1 below. The simulator consists of two separable rendering loops running at different frequencies which are haptic rendering loop and graphics rendering loop. Surface model is being used to represent the human eye and surgical instrument for better visualization while maintain the performance of graphics rendering loop at a minimum rate of 30 frames per second. Collision detection and position tracking running along with the haptic rendering loop is able to maintain 1 KHz refresh rate at all time for haptic stability to compute realistic force feedback [11].

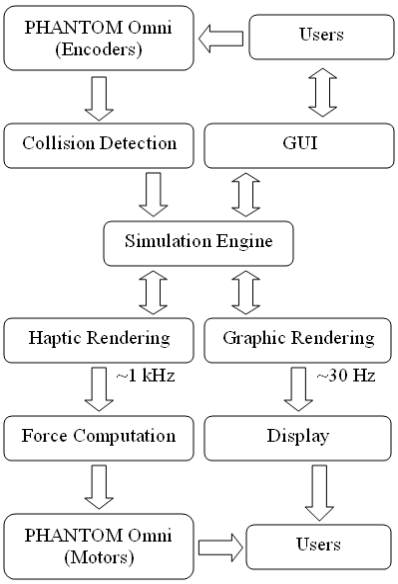


Figure 1. System Architecture

MODELLING TECHNIQUE

Latest computer technology has given various options for researchers to develop precise 3D representation on human model from MRI, CT or ultrasonic scan and even can be illustrated by using different kind of graphics design softwares. Human eye model and surgical instruments in the VR eye surgery simulator are developed by using Autodesk 3ds Max software. Cornea, iris, sclera, muscle and skull are parts that have been designed to represent as an experimental object in the simulator [12].

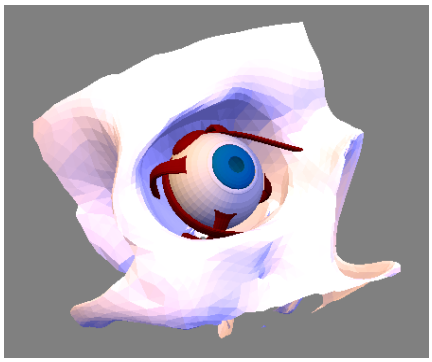


Figure 2. Human Eye Model

The eye model has been saved in OBJ file in order to be rendered by the software. OBJ file contains data of geometric vertices, vertex normal and face. Geometric vertex represents coordinates of 3D model in float number, vertex normal specifies as normal vector for each triangular faces and face indicates a polygon made from the vertices listed. Data in OBJ file is read by the simulator and stored into a mesh in array forms for each part of eye model separately. The mesh consists of vertex container and face container, every triangular facet is drawn by locating position of three vertices from face container and coordinate of each vertex from vertex container. Finally, all triangular faces connected with other neighbour to shape the 3D model. The human eye model which is being developed is shown in Figure 2.

Virtual surgical instruments are generated in the simulator to increase the realism in virtual surgical environment. Some of the research works on VR eye surgery simulator attempt to build an accurate model of eye but present a simple tool for users which will lead to imprecise learning during simulation. Sharp keratome blade, flat keratome blade and phacoemulsification probe are surgical instruments used for cataract surgery [13]. The tools are developed by using the same graphics design software that has been used for designing human eye model. Keratome is responsible for incision of required width on cornea for the insertion of phacoemulsification probe during cataract surgery. The probe vibrates rapidly at ultrasonic frequency of 40,000 Hz in order to emulsify cataract into small fragments and remove them by suction through tip of the probe. The actual feature for each surgical instrument will be implemented for the coming research. Figure 3 below shows one of the virtual surgical instruments that have been designed for the VR eye surgery simulator.

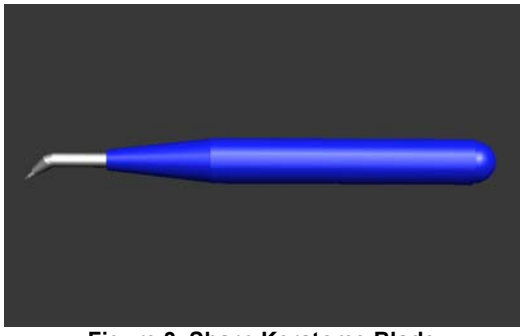


Figure 3. Sharp Keratome Blade

MODELLING TECHNIQUE

Collision detection between rigid objects is necessary in the surgical simulator in the development of basic training tasks [14]. Collision is detected when the tip of surgical tool is touching on the surface of human eye model. Simulator system will acquire the coordinate of contact point by reading the signal from three encoders that equipped in the haptic device. The coordinate of collision is displayed on the screen as a reference for ophthalmologists in surgical planning.
Position tracking system determines the surface of collision by calculating the distance of contact point with the vertices. Each face from face container in the mesh is examined to obtain the set of vertex that used to drawn the surface. The coordinate of vertices are computed with contact point separately in order to obtain the distance. The triangular surface with shortest distance in the container is drawn in green color as shown in Figure 4 below to indicate users the location of collision.

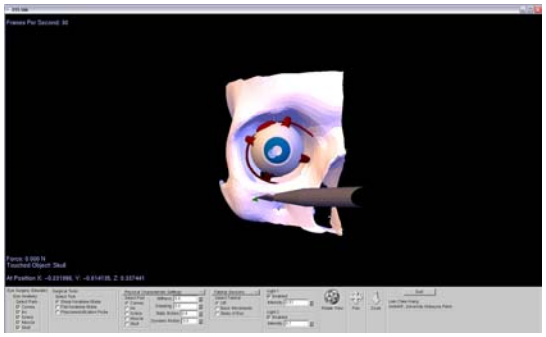


Figure 4. Collision Detection

HAPTIC RENDERING

Haptic rendering is responsible to generate force feedback when there is collision between the tool and the eye model. The tool penetrates into the eye model at the area of collision and this penetration results in the computation of forces to be rendered to the users in the direction opposite to the movement of the stylus. A spring force is generated as the reaction force by applying Hooke's Law as shown in equation (1) below.

$$\mathbf{F} = k\mathbf{x} \quad (1)$$

where, **F** is the 3D force vector calculated at the contact surface; k is the stiffness constant, which determine hardness of eye surface; and **x** is the maximum depth of penetration from the surface of the eye to the immersed position of the surgical tool inside the eye surface.

The spring is attached between a fixed anchor position $\boldsymbol{p}_0$ and device position $\boldsymbol{p}_1$. The fixed anchor position is placed on the surface of the eye that is touched by surgical tool. The displacement of vector x is calculated as shown in equation (2):

$$\mathbf{x} = \boldsymbol{p}_0 - \boldsymbol{p}_1 \quad (2)$$

The reaction force felt is called the restoring force of the spring since the spring is trying to restore itself to the rest length which in this case is zero. The stiffness constant k indicated how aggressively the spring will try to restore to its rest length. A low stiffness constant will feel loose, whereas a high stiffness constant will feel rigid.

The VR eye surgery simulator developed provides a section of GUI platform for ophthalmologists to calibrate the material properties of the eye model in order to receive actual force feedback when touching or applied force on the surface of the eye. The material properties included stiffness, damping, static friction and dynamic friction. Stiffness is the hardness of the object as explained above which associated with the spring force. Damping adds a velocity-dependant property to an object and it is governed by the equation (3) below.

$$\mathbf{F} = k\mathbf{v} \quad (3)$$

where k is the damping coefficient and **v** is the velocity of the device. Static friction is the friction experienced when the surgical tool initially begin motion starting from rest along the surface of eye, whereas dynamic friction is the friction experienced as the surgical tool is moving on the surface.

The material properties for each part of the eye model can be calibrated separately by adjusting the spinner for each category. The values will be saved into the system immediately when there are changes made by the users. This function is implemented into the VR eye surgery simulator in order to provide the best way for ophthalmologists to evaluate the realism of force feedback from haptic device. Some of the simulators developed are required to changes the material properties by editing parameter in the source code of the system which limited the freedom of ophthalmologists to acquire different sensation from haptic device. Figure 5 below shows the force feedback haptic device that is being used in the VR eye surgery simulator.

Figure 5. Phantom Omni (SensAble Technologies Inc.)

RESULTS AND DISCUSSIONS

The VR eye surgery simulator generates 3D human eye model and surgical instruments to imitate real surgical environment. The view of the eye model can be rotated and zoomed in/out for ophthalmologists to learn the structure of human eye and navigate around the area that is unreachable during real situation. The simulator also provides selections on every part of the eye anatomy through the GUI. This feature is unavailable for some of the surgical simulators which rendered the whole model at once.

The eye surgery simulator addressed above is capable to render smooth graphics display which is approximately 30 frames per second throughout the simulation for normal human eye response. Each part of the eye is rendered separately in order to provide higher details on area that is more important in ophthalmology. A few simulators developed by researchers are given more attention to the high details on every part of the eye anatomy which leads to vast computational consumption. Although their simulators can provide great eye model for users, but the simulation on surface deformation and movements of surgical tool will unable to perform efficiently.

Two tutorial sessions are prepared in the simulator for the intention to train new users in handling the stylus of haptic device and studying the eye anatomy. Instructions are given in the first tutorial for users to follow during the learning on basic movements. Users are ordered to touch the surface of specific part of the eye by controlling surgical tool during second tutorial so as to study about the structure of eye anatomy. They can experience the physical properties of the eye model

from reaction force generated by haptic device.
Different types of indicator are created as guidance for users along the simulation in order to reduce uncertainty. The name of specific anatomical structure will be displayed when surgical instrument touched the surface. Amount of force applied on the surface is updated simultaneously with the penetration and warning is given when the applied force has exceeded the limitation. Number of frames per second for graphics rendering is indicated in the simulator to notify users about the performance of the system.

CONCLUSIONS AND FUTURE WORK

In this paper, we described the development of our virtual reality eye surgery simulator. The system can simulates continuous and stable eye surface exploration and force feedback for surgical tool penetration. Computations and renderings on graphics and haptic are based on the triangle mesh models. The collision between the surgical instruments and human eye model are detected efficiently and appropriate reaction forces are generated to the users via haptic device. These haptic and graphics algorithms are done in a computationally inexpensive way to maintain the system stability and conserve the realism of the simulator.
Simulation of cutting feature on the eye surface is planned to be developed into the simulator in order to imitate actual eye surgery procedures that are most common in ophthalmology such as cataract surgery, cornea transplant surgery and glaucoma surgery. Virtual surgical instruments which are developed during previous work will be implemented with different types of cutting feature. The general concept of cutting in virtual reality is manipulating the geometry of the mesh. The triangular face which is touched by the surgical tool will be deleted or separated to illustrate the effect of cutting.

REFERENCES

[1] M. F. Land, and R. D. Fernald, The Evolution of Eyes, Annual Review of Neuroscience 15, pp.1-29, 1992.
[2] X. Shen, A. Hamam, F. Malric, S. Nourian, N. R. El-Far and, N. D. Georganas, Immersive Haptic Eye Tele-Surgery Training Simulation, N.D. 3DTV Conference, pp.1-4, 2007.
[3] M. Agus, E. Gobbetti, G. Pintore, G. Zanetti and, A. Zorcolo, Real-time Cataract Surgery Simulation for Training, Eurographics Italian Chapter Conference (2006).
[4] N.R. El-Far, S. Nourian, J. Zhou, A. Hamam, X. Shen and, N.D. Georganas, A Cataract Tele-Surgery Training Application in a Hapto-Visual Collaborative Environment Running over the CANARIE Photonic Network, Proc. IEEE HAVE 2005, Ottawa, ON, Canada, October 2005, pp.29-32.
[5] R. Barea, L. Boquete, J. F. Pérez, M. A. Dapena, P. Ramos and, M. A. Hidalgo, Cataract Surgery Simulator for Medical Education, Medicon 2007, IFMBE Proceedings 16, 2007, pp.1038-1042.
[6] B. Joshi, A. Fedorov, N. Chrisochoides, S. K. Warfield and, S. Ourselin, A quantitative assessment of approaches to mesh generation for surgical simulation, Engineering with Computers 2008, pp.417-430.
[7] C.A. Diaz, D. Posada, H. Trefftz and, J. Bernal, Development of a Surgical Simulator to training Laparoscopic procedures, International Journal of Education and Information Technologies, Issue 1, Volume 2, 2008, pp.95-103.
[8] SensAble Technologies. http://www.sensable.com. 21/05/2010.
[9] S. C. Elena and, G. H. Felix, Simulation and Training with Haptic Feedback – A Review, International Conference on Virtual Learning(ICVL) 2008.
[10] D. Shreiner, M. Woo, J. Neider and, T. Davis, OpenGL programming guide: the official guide to learning OpenGL, Version 2.1, 6th Edition, Addison-Wesley, July 30, 2007.
[11] A. Liu, F. Tendick, K. Cleary and, C. Kaufmann, A Survey of Surgical Simulation: Applications, Technology, and Education, Vol. 12, Issue 6, (December 2003), published by The MIT Press, pp.599-614.
[12] M.A. Sagar, D. Bullivant, G.D. Mallinson, P.J. Hunter and, I.W. Hunter, A virtual environment and model of the eye for surgical simulation, In: Proc. SIGGRAPH '94 Comput. Graphics A. Conf. (1994), pp.205-212.
[13] Kirkup and, John, The Evolution of Surgical Instruments - An Illustrated History from Ancient Times to the Twentieth Century, Norman Publishing, 2006.
[14] M. Lin and, Gottschalk, Collision Detection Between Geometric Models: a Survey, Proc of IMA Conference on Mathematics of Surfaces, pp.37-56, 1998.

Critical Human Security - Impact of HIV/AIDS at Vulnerable Women in Malaysia

Lim Shiang Cheng[1*]
[1] Centre for Research Management and Graduate, Universiti Pertahanan Nasional Malaysia, Kem Sungai Besi, 57000 Kuala Lumpur, Malaysia
*email address of corresponding author: shiangcheng@yahoo.com

Abstract
The link between HIV and AIDS and human security has become increasingly obvious in recent years and the United Nations Security Council had adopted resolution 1308 in year 2000 which not only addresses HIV as a health issue, but recognizing the risk of the disease especially as a threat to the stability and security of the state. In view of that, this study is aimed to examine the linkages between HIV and human security in Malaysia by assessing the impact of HIV and the threats that expose women to HIV risk. The findings of research will serve as a basis for the development of the policies, strategies and activities for a comprehensive HIV prevention intervention programme by using human security approach to reduce the HIV risk of women and prevent the spread of HIV among other women and general population.

Keywords
AIDS, Community Security, Economic Security, HIV, Health Security, Human Security, Personal Security

INTRODUCTION

Human Security

The concept of human security was introduced by the United Nations Development Programme (UNDP) after the end of the Cold War in 1990. It was first introduced in the 1994 Human Development Report and stated that there is a need to transit the thinking of "security of territory from external aggression to human security" (p.22).

The human security was defined as "safety from such chronic threats as hunger, disease and repression" as well as "protection from sudden and hurtful disruptions in the patterns of daily life – whether in homes, in jobs or in communities." (p. 23). The causes of insecurity were broadened to include threats to economic security (poverty, unemployment, homelessness), food security (under nourishment, famine, hunger), health security (disease, infections, insufficient health care), environmental security (degradation, pollution, natural disasters), personal security (physical torture, war, crime, violence), community security (ethnic tensions, oppression, discrimination) and political security (repression, torture, ill treatment, human rights violations) (p. 25-33).

Human security is instrumental to human dignity and a precondition for social stability. It has moved the focus of "security" from "state-centric to individuals and communities" and most importantly, it underlines the duty of the state to defend people and their rights. It comprised of two elements, which are "freedom from fear" and "freedom from want." (p. 24) and emphasized on the main principles of guaranteeing survival, basic human needs and human dignity. It enables people to exercise choices, pursue social opportunities and plan for their future.

HIV/AIDS as a Direct Threat to Human Security

Applying these criteria, the Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) epidemic today is not simply a health issue but a "critical pervasive threats" to human security especially to health security. HIV and AIDS as a rapid growing global health threat that leads to high morbidity and mortality. The emergence of HIV and AIDS in 1981 has infected and affected many people around the world. Since the beginning, almost 60 million people had been infected with HIV and 25 million people had died of HIV-related causes. In 2008, there were 33.4 million [31.1 million-35.8 million] people living with HIV and women accounted for half of the figure (UNAIDS, 2009).

Besides bringing the most direct affront to human security by lowering life expectancy, HIV and AIDS is also an indirect threat to different components of human securities including economic, food, personal, community and human development at personal, family, community and state level. The economic and food security of a household is affected by HIV and AIDS due the death of adult family members and result in drastic decline in household income. Subsequently, the family members may have less money for food and suffer from malnutrition and become more susceptible to disease. Furthermore, people living with HIV especially women living with HIV tends to face stigma and violence if they reveal their status. The situation becomes worse if they

themselves are sick and cannot continue to take care of their children. This could lead to the dissolution of the family structure. They leave behind children who are orphaned by AIDS and who are more likely to drop out of school due to their inability to pay school fees or because of the social stigma attached to being AIDS orphans.

On the other hand, the linkages between AIDS and state security have also been discussed and raised up at the international platform. These range from demographic impacts (such as an increase in the number of orphans when their infected parents pass away, orphaned youth committing crimes, etc), the macro-economic effects and the inability of government to cope with the extra costs (especially in healthcare set up) incurred by AIDS, to the functioning of key government departments and private industries, due to the severe loss of human capital caused by AIDS illness and death. The epidemic could lead to perceptions and actions that challenge government legitimacy and exacerbate existing tensions between different groups within countries due to differences in access to treatment and subsequently this may challenge the stability of a nation if the threats of HIV remain unchecked.

In view of that, the United Nations Security Council had made a historical move in year 2000 by adopting resolution 1308 which not only addresses HIV as a health issue, but recognizing the risk of the disease especially as a threat to the stability and security of the state. The resolution further recognizes the symbiotic relationship between HIV and AIDS and security and notes that the pandemic "is also exacerbated by conditions of violence and instability, which increase the risk of exposure to the disease through large movements of people, widespread uncertainty over conditions, and reduced access to medical care."

HIV and AIDS situation in Malaysia

In Malaysia, the first case of HIV infection was reported in 1986 and the total cumulative reported cases in Malaysia as of December 2008 stood at 84,630 HIV positive cases, 14,576 AIDS cases and 11,384 AIDS death cases (MOH Malaysia, 2008). Although Malaysia is classified as a country with a concentrated epidemic among the most at risk population such as injecting drug users (IDUs), men who have sex with men (MSM) and sex workers, the trend of transmission that is happening in other parts of the world now has arrived in Malaysia, i.e. the number of women who are infected through heterosexual sex is increasing. By 2008, women made up almost one fifth of the newly infected persons throughout Malaysia. 63.9% HIV infection among women in Malaysia have occurred through heterosexual intercourse and majority of them were found to be housewives (26.3%), followed by industrial workers (4.1%) and sex workers (2.8%) (MOH Malaysia, 2008).

As compared to men, women are generally more vulnerable to HIV infection due their biological factors. Women also face a greater risk to HIV as compare to men due to factors such as economic security, personal security, social, cultural and gender inequality. Women frequently become victims of gender-based violence, that include containing sexual abuse and domestic violence, at risk of getting raped, being coerced or trafficked into prostitution or exchange sex for survival due to poverty. Moreover, due to gender inequality, women living with HIV/AIDS often have to suffer violation of their human rights, like the right to bodily integrity, access to health services, education and medicine.

The increased number of HIV infection cases among women through their partners or husbands has alerted the Malaysian government that HIV infection may emerge further among the general populations and Malaysia may not be able to achieve the Millennium Development Goal in 2015 due to the failure in combating HIV and AIDS. Realizing this situation, the government has in fact responded by setting up a high powered Cabinet Committee on HIV under the Deputy Prime Minister to tackle this menace. Ministry of Health Malaysia also collaborated with governmental, non-governmental agencies and other ministries on re-developing the National AIDS Strategic plan to provide a framework as Malaysia's response to HIV and AIDS threats. The framework focused on prevention, treatment and care program among women, young people and the most at risk population. With the adoption of the Strategic Plan, more resources had been allocated especially the funding from the Government increased from less than RM 35 million to almost RM 100 million each year.

SIGNIFICANCE OF THE STUDY

Although the Malaysian government has responded to the HIV problem by setting up a high powered Cabinet Committee on HIV [the committee was restructured to National Coordinating Committee on AIDS Intervention (NCCAI), chaired by the Minister of Health in 2009] and a 5 year National Strategic Plan on HIV and AIDS, 2006 – 2010, the epidemic is always addressed as a health issue but not as a threat to human security in Malaysia. This may be due to the HIV epidemic in Malaysia being classified as at the concentrated stage with high prevalence among high risk populations, mainly injecting drugs users (IDU), men who having sex with men (MSM) and sex workers

(SW) and the HIV prevalence in general population is less than 0.05%. However, it should be noted that the number of girls and women who have been infected through heterosexual sex is increasing and these women are mainly from the general population.

As the disease will jeopardize personal, communal, and state security if the problems remain unchecked, therefore, there is a strong urge to know and understand the relationship of HIV to human security. The study will explore the impact of HIV and how it becomes a threat to the people living with HIV especially women living with HIV and bring the effects to different components of the securities (ranged from economic, food, health, personal and community) in their lives.

Furthermore, as human insecurity and internal or external instability and conflict can accelerate the spread of HIV, and women are generally more vulnerable to HIV infection as compared to men, thus, this study will also assess threats (human insecurity) that expose women to HIV risk.

The findings of the research will serve as a basis for the development of policies, strategies and activities for a comprehensive HIV prevention intervention programme by using human security approach to reduce the HIV risk of women and prevent the spread of HIV among other women and general population. By addressing HIV as a human security issue, it means protecting people from this critical and pervasive threat through building on their strengths and aspirations. It also means the need to create a system that give people the building blocks of survival, dignity and livelihood. Indirectly, by addressing HIV as a human security issue, this will complement the state security by being people-centered and contribute to the government efforts in reversing the increasing trend of HIV and achieving the Millennium Development Goals.

REFERENCES

[1] Elbe. S. (2006). *HIV/AIDS: A Human Security Challenge for the 21st Century*. University of Sussex.

[2] Khalib, A. M. (2008). *Women and Girls: Confronting HIV and AIDS in Malaysia.* Ministry of Health and United Nations Children's Fund (UNICEF), Malaysia.

[3] McInnes, C. (2008). Health. *Security Studies – An Introduction.* Routledge, New York

[4] Tiessen, R. (2006). *A Silent Killer: HIV/AIDS Metaphors and Human (In) Security in Sourthern Africa. A Decade of Human Security*, Ashgate Publishing Limited, England

[5] The Global Coalition on Women and AIDS and Joint United Nations Programme on HIV/AIDS (UNAIDS). (2006). *Economic Security for Women Fights AIDS*. Geneva: UNAIDS

[6] United Nations Country Team, Malaysia (2005). *MALAYSIA: Achieving the Millennium Development Goals - Successes and Challenges*. United Nations Development Programme, Malaysia.

[7] United Nations Security Council. (2000). *Resolution 1308 (2000)*.

[8] *UNGASS Country Progress Report 2006: Malaysia. (2006*). Malaysia: AIDS/STD Section of the Disease Control Division, Ministry of Health, Malaysia.

[9] *UNGASS Country Progress Report 2008: Malaysia. (2008*). Malaysia: AIDS/STD Section of the Disease Control Division, Ministry of Health, Malaysia.

[10] UNAIDS and WHO. (2009). *AIDS Epidemic Update 2009*. Geneva: UNAIDS

[11] UNAID). (2008). *Report on the global HIV/AIDS epidemic 2008. Geneva:* UNAIDS

[12] UNDP (1994). *Human Development Report 1994*

Image Filtering Procedure for Noise Reduction in Ziehl-Neelsen Sputum Slide Images

R. A. A. Raof[1], R. B. Ahmad[2]
School of Computer and Communication Engineering, Universiti Malaysia Perlis,
01000 Kangar, Perlis.
rafikha@unimap.edu.my[1], badli@unimap.edu.my[2]

M. Y. Mashor
School of Mechatronic Engineering, Universiti Malaysia Perlis, 01000 Kangar, Perlis.
yusoff@unimap.edu.my

S. S. M. Noor
Department of Microbiology and Parasitology, School of Medical Sciences,
Universiti Sains Malaysia, Kelantan.
ssuraiya@kck.usm.my

Abstract
Image filtering is an important approach in the area of digital image processing for noise reduction. The time cost and output image quality in the filtering system are two convention measures in selecting the appropriate filtering algorithm. In this paper, a modified median filter algorithm is presented for noise reduction in Ziehl-Neelsen sputum slide images that are corrupted by impulse or salt and pepper noise. It is combined with a region growing technique to remove noises which are bigger in size. The procedure has been tested on samples image from various categories. The proposed method shows a good performance in filtering the noise in the Ziehl-Neelsen sputum slide images.

Keywords
Image filtering, median filter, region growing, tuberculosis, Ziehl-Neelsen

INTRODUCTION

Globally, there were an estimated 9.27 million incident cases of tuberculosis (TB) in 2007. This is an increase from 9.24 million cases in 2006, 8.3 million cases in 2000 and 6.6 million cases in 1990. Most of the estimated number of cases in 2007 were in Asia (55%) and Africa (31%), with small proportions of cases in the Eastern Mediterranean Region (6%), the European Region (5%) and the Region of the Americas (3%). The five countries that rank first to fifth in terms of total numbers of cases in 2007 are India (2.0 million), China (1.3 million), Indonesia (0.53 million), Nigeria (0.46 million) and South Africa (0.46 million). Of the 9.27 million incident TB cases in 2007, an estimated 1.37 million (15%) were HIV-positive; 79% of these HIV-positive cases were in the African Region and 11% were in the South-East Asia Region [1].

Ziehl-Neelsen stain method is one of the common techniques that are being used to diagnose the tuberculosis (TB) infection. Smear microscopy with Ziehl-Neelsen technique has been the main means of diagnosing TB patients in developing countries. This is because the method is simple, rapid, reproducible, low cost and effective in detecting infectious disease such as TB [2].

In this research, images of Ziehl-neelsen sputum slides are captured using a digital camera attached to a light microscope and displayed on a computer screen. In order to extract the mycobacterium tuberculosis images from the TB slide images, several image processing techniques are required. One of the image processing techniques is filtering, which is useful to filter the unwanted noise in the TB slide images.

Median filters are particularly effective in the presence of impulse noise, also called salt-and-pepper noise because of its appearance as white and black dots superimposed on an image [3]. However, the original median filter algorithm is based on full sorting of pixels in the sliding window. The computational complexity grows rapidly with the square of sliding window area [4].

The seed-based region growing (SBRG) is one of the well-known segmentation techniques [5]. However, it also have been used in many other research for feature extraction and labelling purposes [6][7].

In this paper, a modified median filter algorithm together with automated SBRG is presented for noise reduction in Ziehl-Neelsen images that are corrupted with impulse or salt-and-pepper noise. The objective of the modification in median filter is to reduce time spent in filtering stage and hence further reduce the overall time taken to automatically diagnose the sputum slide of TB patients. Region growing is applied to further filter bigger sized noise that is unable to be filtered in the first stage.

METHODOLOGY

The research methodology is mainly divided into two steps: image thresholding and image filtering.

Image Thresholding

The original images are first saved into bitmap (*.bmp) files with the resolution of 800 x 600 pixels. Figure 1 shows samples of images of Ziehl-Neelsen sputum specimens that have been captured automatically using an automated capturing system that has been developed to control the digital camera and the motorized stage of a light microscope.

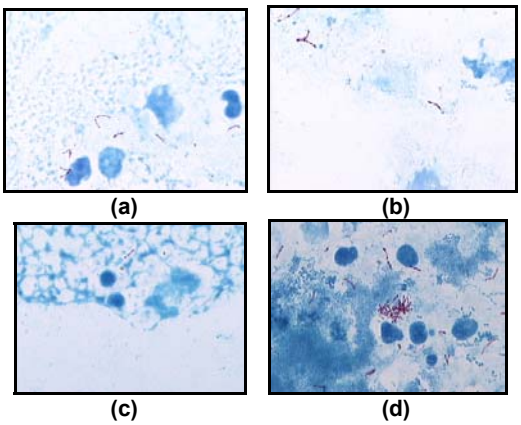


Figure 1. Samples of sputum slide images consisting TB bacilli

The first stage involves image thresholding of the TB bacilli on Ziehl-Neelsen sputum specimens. In this process, the pixels that are having the characteristics of TB bacilli are retained and the unwanted pixels are eliminated. These unwanted pixels consist of background and sputum cells. Color thresholding method using Hue, Saturation, Intensity (HSI) information has been used to extract the TB bacilli from the images [8]. The output of thresholding stage is shown in Figure 4(b) and 5(b).

It can be seen that the pixels that are originally representing the background and sputum cells have been changed to white, and the TB bacilli pixels are changed to red colour. However, it can be noted that the thresholding process could not totally removed the unwanted pixels because of the similarity in the characteristics of TB and the unwanted pixels. Hence, the remaining unwanted pixels appear as salt and pepper noise in the resulted image of thresholding process as reflected in Figure 4(b) and 5(b).

Image Filtering

This section is further divided into two steps: modified median filter and region growing.

Modified Median Filter

The original median filter algorithm is widely used for noise reduction due to its good smoothing performance [6]. It is often used for images with gray level intensity. As its name implies, it works by replacing the value of a pixel by the median of the gray levels in the neighborhood of the pixels. This neighborhood can also be represented by mask. A square mask or neighborhood of *n x n* pixels as shown in Figure 2 are selected, where n is an odd number of either 3, 5, 7 or so on.

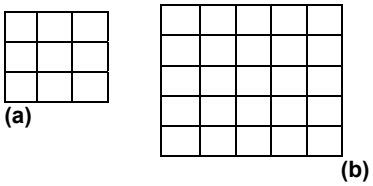


Figure 2. Square mask of *n x n* pixels with (a) *n* = 3 (b) *n* = 5

Specifically, the median filter replaces a pixel by the median value of all pixels in the neighborhood as shown in Equation 1.

$$out(x,y) = median\left\{ in\ (x,y)\ ,(\mathbf{x,\ y}) \in\ w\ \right\} \quad \textbf{[1]}$$

where w represents the neighborhood centered around location input pixels, in (x, y) in the image and out (x, y) represents the resulted pixel of the median filter.

After the thresholding process, the output image as shown in Figure 4(b) and 5(b) has been converted into binary image, whereby the TB bacilli are represented as red pixels and sputum and background are represented as white pixels. Due to this reason, the implementation of median filter could be modified to overcome the existing computational and sorting issue in the original algorithm. Instead of processing every entry/pixel in the neighborhood, the number of white and non-white pixels is counted until one of it reaches half of the neighborhood's size. In this study, a neighborhood of 3 x 3 is used, therefore half of the neighborhood's size will be 5.

The modified median filter is implemented as in steps below:

1. Read the intensity value of the pixels in a specified neighborhood one by one until a total of 5 pixels have been read.
2. If the amount of either white or red pixels is equal to 5, replace the center pixel with white or red pixel respectively and proceed to step 3. Else, read the intensity value of next pixel and repeat step 2.
3. Move the neighborhood one pixel to the left.
4. Repeat steps 1-3 until the end of the row.
5. Proceed to the next row.
6. Repeat steps 1-5 until all pixels in the image have been processed.

The output of applying modified median filter to the thresholded image is shown in Figure 4(c) and 5(c).

Region Growing

After the threshold images were filtered, automated SBRG is used to label and calculate the size of the remaining objects. The size of a region is calculated by the total number of pixel for the region. Size is an important feature in order to validate whether a segmented region is considered as TB bacilli or noise. The implementation of automated SBRG can be based on 4 adjacent neighbour, 4 diagonal neighbour or 8 surrounding neighbour. This study considered the implementation based on 8-surrounding neighbour as shown in Figure 3.

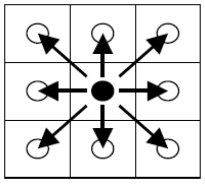


Figure 3. Growing seed pixel based on 8-surrounding neighbour

The algorithm for automated SBRG is as follows [9]:

1. Examine all pixels in the image. Set the first non-white pixel as the initial seed location, $p_o(x, y)$. Add region label to $p_o(x, y)$. Set the size of the current label to 1.
2. Compare each neighbour pixel to the seed. If the intensity of the neighbour pixel is equal to the seed, the, add the respective pixel to the region. Add same region label as in (1) to the respective pixel. Increase the size of the label by 1.
3. Set the neighhbour pixel, which has just been added to the region, as the new seed location.
4. Repeat steps (2) – (3) until the region cannot grow anymore or all the pixels have been considered.
5. If the size of the current region is less than 85, then change the pixel color of the respective region to white.
6. Repeat steps (1) – (4) for the remaining unlabelled pixel in the image.

For TB detection, the size of tubercle bacilli existing in the sputum slide images must be at least 85 pixel. Therefore, any region that are detected to be less than this size will be automatically deleted from the image.

RESULTS AND DISCUSSION

The method described above are tested on images from five categories. The results of applying the method are presented in Figure 4 and 5. Figure 4-5 (a) show the original captured images while Figure 4-5 (b) show the image after thresholding process using HSI threshold method. It can be seen that most of the background pixel have been eliminated at this stage.

In order to verify that the modified algorithm can filter off salt-and-pepper noise, Figure 4-5(c) show the output image after filtering using modified median filter algorithm. At this point, most of the salt and pepper noise existing previously have already been eliminated. However, there are still regions which are bigger in size that are unable to be filtered using the modified median filter process. Hence, an automated SBRG algorithm is applied to the image resulted from modified median filter. After the region growing algorithm has been applied, the output images appear to be cleaner and the segmentation process was considered to be completed. The resulted images are shown in Fig. 4-5(d).

CONCLUSION

A modified method for image filtering for Ziehl-Neelsen sputum slide is presented based on the existing median filter algorithm. The method which has been combined with automated SBRG show a good performance particularly in reducing the unwanted noise in binary images.

REFERENCES

[1] WHO Report 2009, *Global tuberculosis control 2009: Epidemiology, Strategy, Financing* (2009).

[2] Luna, J. A. C, *A Tuberculosis Guide for Specialist Physicians*, International Union against Tuberculosis and Lung Disease (2004).

[3] Gonzalez, R. C., and Woods, R. E., *Digital Image Processing*, Second Edition. Pearson Education, 2nd Ed., New Jersey (2002).

[4] Wang, K., Xie, Y., Li, S., and Chai, Y., "An Improved Median Filtering System and Its Application of Calcified Lesions' Detection in Digital Mammograms". In *Medical Imaging and informatics: 2nd international Conference*, MIMI 2007, Beijing, China, August 14-16, 2007

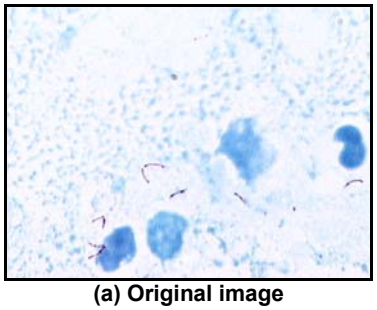
[5] Adams, R., and Bischof, L., "Seeded Region Growing", IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 16, No. 6, (June 1994).

[6] Masutani, Y., Masamune, K., and Dohi, T. "Region-Growing Based Feature Extraction Algorithm for Tree-Like Objects". In *Proceedings of the 4th international Conference on Visualization in Biomedical Computing*, September 22 - 25, (1996).

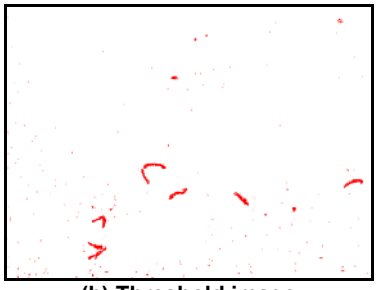
[7] Yoshitaka, M., Ken, M. and Takeyoshi, D., "Region-growing based feature extraction algorithm for tree-like objects", Proceedings of 4th International Conference of Visualization in Biomedical Computing, Germany, September 22–25, (1996).

[8] Raof, R. A. A., Mashor, M. Y., Ahmad, R. B., and Noor, S. S. M., "Comparison of Colour Thresholding Method Using RGB and HSI Information for Ziehl-Neelsen Sputum Slide Images", *10th International Conference on Information Sciences, Signal Processing and their Applications (ISSPA 2010)*, 10-13 May, (2010).

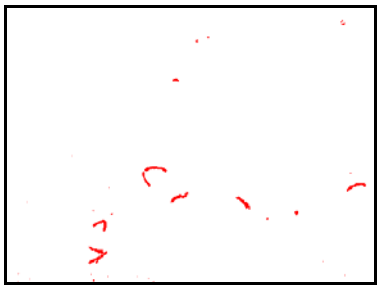
[9] Isa, N. A. M., Mashor, M. Y., and Othman, N. H., "Automatic Seed Based Region Growing for Pap Smear Image Segmentation". *Proceedings of Kuala Lumpur International Conference on Biomedical Engineering (BioMed2002)*. pp. 167-169. Kuala Lumpur, Malaysia, 5-8 June, (2002).



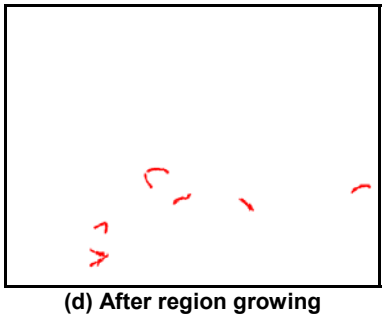
(a) Original image



(b) Threshold image

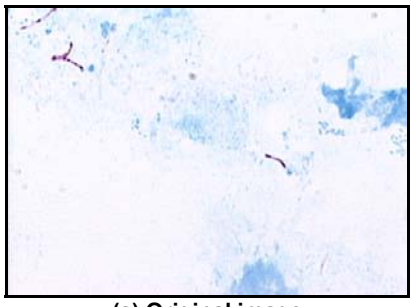


(c) After median filter

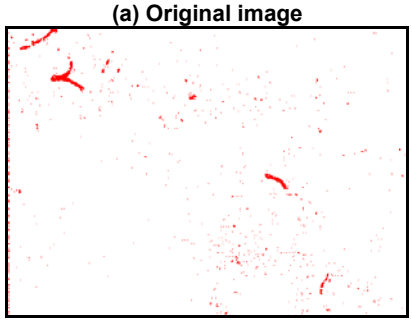


(d) After region growing

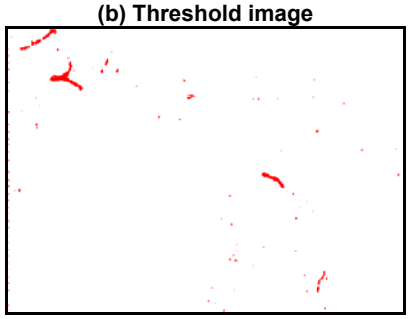
Figure 4. Image 1 and its results



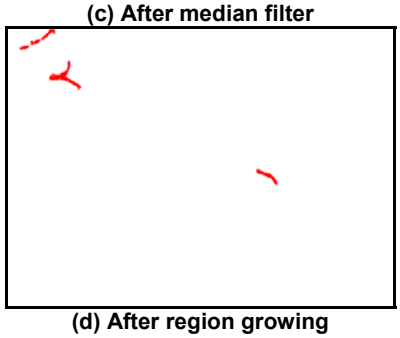
(a) Original image



(b) Threshold image



(c) After median filter



(d) After region growing

Figure 5. Image 2 and its results

A Preliminary Study of Fuzzy Expert System Design for Diagnosis of Hypertension

A.A. Azamimi[1*], Z. Rosniza[1] and M.N. Farahiyah[1]
[1]School of Mechatronic Engineering, Universiti Malaysia Perlis (UniMAP),
Kampus Ulu Pauh, 02600, Arau, Perlis, MALAYSIA.
*azamimi@unimap.edu.my

Abstract
The aim of this study is to design a Fuzzy Expert System (FES) for diagnosis of hypertension risk for patients aged between 20's,30's and 40's years and is divided into male and female gender. The input data is collected from a total of 18 people which consists of 9 women and 9 men. The parameters used as input for this fuzzy expert system were age, BMI, blood pressure and heart rate. Hypertension was diagnosed if blood pressure is over than 140/90mmHg. Hypertension is called the silent killer because it has no symptoms and can cause serious disease if left untreated for a long time [8]. Thus, an intelligent and accurate diagnostic system is needed in order to threat the hypertension patient. It is expected that our proposed fuzzy expert system can provide a faster, cheaper and more accurate result compared with other traditional methods.

Keywords
Hypertension, Blood Pressure, Fuzzy Expert System (FES), Medical Diagnosis

INTRODUCTION

Nowadays the methods of artificial intelligence have largely been used in the medical applications. In the medicine area, many expert systems were designed to diagnose and treatment the disease [4]. Hence, a rule-based fuzzy expert system that simulates an expert-doctors behavior for diagnosis of the disease is developed. Fuzzy logic is a true extension of conventional logic, and fuzzy logic controllers are a true extension of linear control models. Hence anything that was built using conventional design techniques can be built with fuzzy logic, and vice-versa. However, in a number of cases, conventional design methods would have been overly complex and, in many cases, might prove simpler, faster and more efficient. On the other hand, high blood pressure or hypertension is a condition that occurs when the pressure in our arteries is consistently above the normal range. Blood pressure is the force of blood pushing against the wall of the arteries [8]. Hypertension is diagnosed when blood pressure is over 140/90mmHg and it is also can cause of death. Hence, it is important to develop an expert system that can provide the user the information on factors and risks of hypertension so that a proper medication can be planned without delay. As laboratory data, blood pressure, BMI, age, heart rate and life-style of the patient are used. Using this data and help from an expert doctor, the fuzzy rules to determine the risk factor of having high blood pressure are developed. The developed system is expected to give the user the patient possibility ratio of the hypertension.

LITERATURE REVIEW

Many methods have used computed technology in the fields of medicine area to diagnosis and treatment of illness and patient pursuit has highly increased. The methods of artificial intelligence have largely been used in the medical applications to diagnosis and treatments are likes fuzzy expert system, neural network, expert and knowledge-based system, statistical, fuzzy model and Bayesian statistics. So, this study is aimed to apply between fuzzy logic and expert system in order to diagnosis hypertension disease.

Data acquisition methods

There are a few data can be used in medical to diagnosis the diseases. These data can offer a powerful framework to construct the model to a valuable factor towards medical diagnosis improvement.

M. Neshat, M. Yaghobi, M. B.Naghibi and A. Esmaelzadeh [4] propose and execute a method of study that simplifies data model and calculation by using the fuzzy expert system design for diagnosis of liver disorder [4]. The samples in this collection are collected by the site UCI which is the 345 samples and each sample consists of 7 qualities. The attribute information included Mcv means corpuscularvolume Alkphos, Alkaline phosphates, Sgpt alamine aminotransferase, Sgot aspartate, minotransferase, Gammagt gamma-glut amyl Tran peptidase, Drinks number of half-pint equivalents of alcoholic beverages Drunk per day, and Selector field used to split data into two sets [4]. This Fuzzy used the rule base, each rule is collection of variants "AND" together and show an especial situation of diseases. Table 1, show L-low, M=medium and B=big the rules for this model [4].

Table1. Fuzzy rule base

#	MCV	ALP	SGPT	SGOT	Gammagt	Drink	L_D
1	M	M	M	M	M	M	L
2	M	M	M	M	M	L	L
...							
78	B	H	H	H	H	H	H

A. Blinowska and G. Chatellier [2] propose the Bayesian method to diagnosis hypertension. The parameters used are general information such as age, sex, body weight, blood pressure, Biochemical data, and sign taken from the Artemis data base of the Broussais Hospital's Hypertension Clinic [9]. The expected loss corresponding to get the six possible decisions could be calculated this cases. To elaborate a statistical aid for hypertension diagnosis, several classical techniques can be use discriminatory analysis, probit, and logistic regressions. The Bayesian method is a based on the calculation of the posterior probability *PI (J)* of each state of nature θ1 that shown in Equation (1).

$$P_i(J) = \pi(\theta_i) * \text{index}_i(J) \Big/ \sum_{i=1}^{6} (\pi(\theta_i) * \text{index}_i(J)). \quad (1)$$

Novruz Allahverdi, Serhat TORUN and Ismail SARITAS used the Fuzzy Expert System method to diagnosis the coronary heart disease risk of patient the next ten-years [10]. A fuzzy expert system design system used for calculating and determine the drug dose also. The parameters used in this study are age, cholesterol level, high density lipoprotein cholesterol and blood pressure level essentially to determine the CHD risk. This method used rules for diagnosis this disease. For example these rules are 'IF age is young and cholesterol is low and HDL-C is low and blood pressure is low', 'IF age is young and cholesterol is low and HDL-C is low and blood pressure is middle' and 'IF age is young and cholesterol is low and HDL-C is low and blood pressure is high THEN risk is very low' [10].

Sylvie Charbonnier, Sylvie Galichet, Gilles Mauris and Jean Phillipe Siche proposed the Statistical and Fuzzy models of Ambulatory Systolic Blood Pressure for hypertension diagnosis. The ASBP will measure and records blood pressure every 15 min during the day and every 30 min during night for patient in normal life [3]. A statistical regression model whose parameters depend on the body acceleration value. It is based on prior knowledge on the ASBP variations [3].

System design

M.Neshat, et al.,[4] wrote that them system is compound of an expert and a fuzzy system and they are known as hybrid systems (fuzzy expert) to designed for disease and consists of expert individual, knowledge engineer and fuzzy System. Fuzzy system consists four parts is fuzzy rule base, fuzzy inference engine, Fuzzification, and defuzzification. In the works that have done, always, liver disorders have been divided into two parts of people with healthy liver and unhealthy people and no report based on patient calibration has been seen, however, always each person has a grade of health and a grade of illness. In this research for calibration of disease risk intensity measure, the tool (FIS) in (MATLAB) software is used as shown in Figure 1 [4].

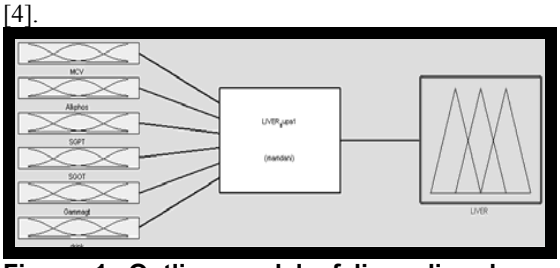


Figure 1. Outline model of liver disorders fuzzy expert system

METHODOLOGY

Data collection

The subject groups involved in this project were female and male groups, mainly selected among UniMAP students and staffs. Subjects were selected to get the parameters like age (range between 20's to 40's years old), gender (male and female), BMI level, blood pressure (120/80mmHg), and heart rate. In addition, to know the background of the subjects questions such as employment, drinking, medical history, favorite food and exercise was asked to facilitate the review. Using a total of 18 subjects and was divided into two groups. For gender were divided into male and female, while for ages divided into three groups such as 20's years, 30's years and 40's years. All procedures were approved by the supervisor and written informed consent was obtained from the participants before data collection.

Hardware and software configuration

In this project, the analysis focused on how to design an expert system to diagnosis hypertension performed by range of age participants. The fuzzy system is used to design and diagnosis the hypertension the subjects.

Blood pressure

To measure the blood pressure, Non invasive blood pressures (NIBP) are used to get the reading. The normal blood pressure is 120/80mmHg where the 120mmHg is a Systolic (maximum) and 80mmHg is a Diastolic (minimum) [7]. When the blood pressure more than 139/89mmHg, the hypertension can occurred. The stage of hypertension will be divided into three stage; for the first stage around 159/99mmHg, second stage around 179/109mmHg and lastly more than 180/109mmHg [8].

Body Mass Index (BMI)

To get the BMI, the scales for weight and height gain is used. Body mass index is defined as the individual's body weight divided by the square of his or her height [11]. The formula universally used in medicine produce a unit of measure of kg/m^2 [11]. The BMI can divide to three categories BMI range. First category range 19 to 25 is having a healthy weight. The second category in range 16 to 18 is an underweight. The third category is ranged 25 to 30 are considered to be overweight [11].

Fuzzy Expert Systems (FES)

A fuzzy expert system is a collection of membership functions and rules that are used to reason about data. Unlike conventional expert systems, which are mainly symbolic reasoning engines, fuzzy expert systems are oriented toward numerical processing. The part of the rule between the "if" and "then" is the rule's _premise_ or _antecedent_ [6]. This is a fuzzy logic expression that describes to what degree the rule is applicable. This design has been divided into several steps. First steps are fuzzification, the second step is the rule evaluation, aggregation of the third rule, and finally defuzzification [5]. To design the system, the FIS tool in MATLAB is used.

RESULTS AND DISCUSSIONS

Table 2 shows all data collected from subjects which consist of 3 males and 7 females ranged between 20 and 50 years old.

Table 2. Result from data collection.

Gender	Age	BMI (kg/m^2)	Blood Pressure (mmHg)	Heart Rate (bpm)
F	23	20.3	112/68	82
F	24	20.3	120/79	104
F	22	18.6	107/68	90
M	23	25	111/77	67
M	23	25.7	115/76	75
M	26	24.7	123/74	66
F	30	22.1	121/81	81
F	33	23.9	122/73	79
F	30	23.1	126/91	81
F	45	23.7	114/73	70

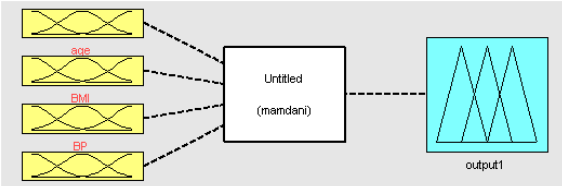


Figure 2. The outline of hypertension fuzzy expert system

Then, fuzzy expert system is designed to diagnose hypertension by using fuzzy inference system (FIS) tool [6]. This design consists of 4 inputs and 1 output whereas for the fuzzification, Mamdani method is used. The inputs consist of blood pressure, BMI, heart rate and age. The variables are used like low, middle, medium and high for input and low, middle and high for output. The outline of our proposed fuzzy expert system can be shown in Figure 2.

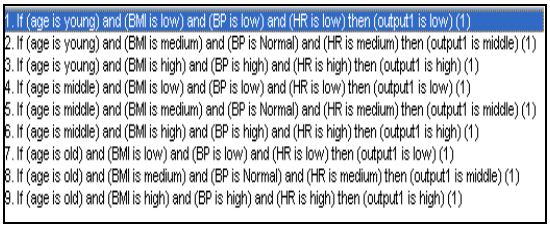


Figure 3. Developed fuzzy rules

Here, 9 rules are designed using fuzzy rule base as shown in Figure 3. The rules have been developed using *if-then* method. For example, if Age is Young and BMI is Low and BP is Low and HR is low then the output risk is Low. Using these rules, the result risk in term of percentage (%) has been computed. Figure 4 shows the result for the subject at the age of 23 years old, BMI is 20.3 kg/m², blood pressure is 112/68 mmHg and heart rate is 82 bpm. So, the output result obtained for this subject is 50%. This means that the subject has 50% risk to get hypertension based on the factor of age, BMI, blood pressure and heart rate. For the surface result, we can see the output for BMI versus Age in three dimensions as shown in Figure 5.

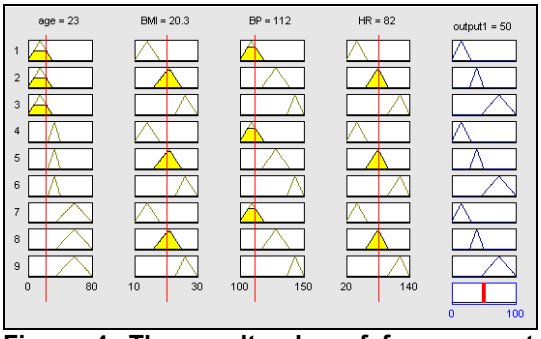


Figure 4. The result rules of fuzzy expert system

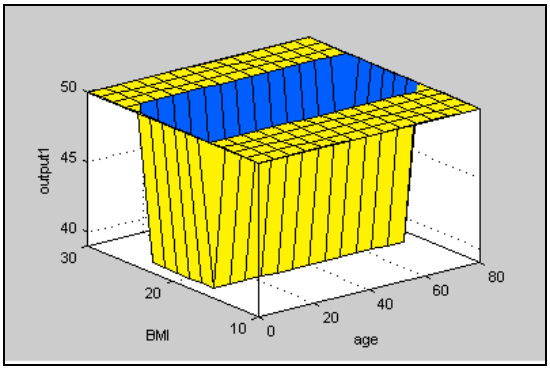


Figure 5. Surface view of fuzzy expert system

Table 3. Result for the risk of hypertension

Subjects	Gender	Age	BMI (kg/m²)	Blood Pressure (mmHg)	Heart Rate (bpm)	Risk (%)
1	F	23	20.3	112/68	82	50
2	F	24	20.3	120/79	104	50
3	F	22	18.6	107/68	90	50
4	M	23	25	111/77	67	50
5	M	23	25.7	115/76	75	50
6	M	26	24.7	123/74	66	50
7	F	30	22.1	121/81	81	39
8	F	33	23.9	122/73	79	39
9	F	30	23.1	126/91	81	39
10	F	45	23.7	114/73	70	50

Table 5 shows the result for the risk of hypertension. It is consisted of age from 20's to 40's for males and females. For the age 20's the risk to get the hypertension are about 50%, for the age 30's are 39% and lastly for 40's are 50%. From the result, subject number 2 have a high reading for the heart rate is 104 and the risk to get the hypertension is 50%. For the age around 20's, all the subjects have 50% risk to get the hypertension. It is maybe because the pressure in their study and not having a healthy life such as lack of exercises, depression and stress.

Hence, to make sure this system can provide more accurate results; many rules will be developed for this fuzzy expert system.

CONCLUSION

Fuzzy expert system design is very appropriate compared to the Bayesian Statistics, Statistical and other methods. This is because fuzzy expert system can simulate as an expert doctors behavior in order to diagnose the disease. This study is aimed to design a fuzzy expert system for diagnosis of hypertension. For current progress, age, BMI, heart rate and blood pressure are used as input for the fuzzification method while risk of hypertension (%) is used as output. For the next progress, we will add ECG waves as another input to give further analysis of the condition of patient hypertension. More fuzzy rules will be developed in order to get a better result and determine the risk factor of hypertension.

REFERENCES

[1] Riccardo P. and Stefano C. A Neural Network Expert System for Diagnosing and Treating Hypertension, University of Florence Riccardo Livi, pp.64-71. 1991

[2] Aleksandra B., Gilles C., Jacques B., and Marion L., Bayesian Statistics as Applied to Hypertension Diagnosis, IEEE Transactions On Biomedical Engineering. Vol. 38. No.7. Y 1991

[3] Sylvie C., Sylvie G., Gilles M., and Jean P. S., Statistical and Fuzzy Models of Ambulatory Systolic Blood Pressure for Hypertension Diagnosis, IEEE Transactions On Instrumentation And Measurement, Vol. 49, No. 5, OCTOBER 2000, pp.998-1003

[4] M. Neshat, M. Yaghobi, M. B Naghibi, A.Esmaelzadeh, Fuzzy Expert System Design for Diagnosis of liver disorders, Department of Computer Engineering, Azad University of Mashhad Iran 2008 International Symposium on Knowledge Acquisition and Modeling, pp.252-256

[5] S. N.Sivanandam, S. Sumathi and S. N. Deepa, (2007). Introduction to Fuzzy Logic using MATLAB,pp. 304-309.

[6] Michael Negnevitsky, (2004). Artificial Intelligence, A guide to Inteligent Systems, Second Edition,Addison-Wesley.

[7] T. O Lim and Z Morad (1996). Prevalence, Awareness, Treatment and Control of Hypertension in the Malaysian Adult Population: Results from the National Health and Morbidity Survey 1996.

[8] Hypertension from Wikipedia the free encyclopedia. Retrieved July 29, 2010, from http://en.wikipedia.org/wiki/Hypertension

[9] P. Degoulet,C. Devries, and D. Sauquet, "Data and knowledge management integration in hospital information system," in Towards News Information Systems, Amsterdem, North-Holland, 1989, pp. 149-156.

[10] Novruz ALLAHVERDI, Serhat and TORUN Ismail SARITAS, Fuzzy Expert System Design for Determination of Coronary Heart Disease Risk, International Conference on Computer Systems and Technologies (2007).

[11] National Heart Lung and Blood Institute, U.S Department of Health & Human Services. Retrieved Oct 10, 2010, from http ://www.nhlbisupport.com/bmi.

World Microbial Culture Collections: A Graphical View

Olumide Adedokun ODEYEMI[1,*], Olawale Faith-Anthony AKINNUOYE[2] and Solakunmi O. OLUWAJOBA [3]

[1] Marine Microbiology Laboratory, School of Biosciences & Biotechnology, Faculty of Science & Technology, Universiti Kebangsaan Malaysia 43600,UKM Bangi,Malaysia [2] School of Biosciences & Biotechnology, Faculty of Science & Technology, Universiti Kebangsaan 43600 UKM Bangi, Malaysia ,[3] Bells University of Technology, Otta, Lagos, Nigeria

*oluodeyemi@gmail.com:+60163087064

ABSTRACT

The advent of biotechnology in 21st century revolutionalized the entire field of life and natural sciences. It has led to various scientific discoveries and breakthroughs with academic, medical, agricultural, environmental and industrial benefits. Biotechnology is a broad field of science that involves various disciplines such as biochemistry, microbiology, molecular biology, genetics and chemical engineering. Advancement of biotechnology from a global perspective depends not only on manpower, infrastructures, fund and equipment. It also depends on biological systems required and utilized. Biological systems such as microorganisms, plants and animals are essential for a successful biotechnology. There is therefore need to adequately preserve these systems. Microorganisms are collected and maintained in culture collections worldwide. However; only 68 countries have culture collection centres registered with World Data Centre for Microorganisms (WDCM) as at July 2010 out of 152 countries in the world. A functional and effective culture collection is a vehicle to biotechnological advancement because micro-organisms with economic importance are to be collected and preserved on long term view.

Keywords

Microbial culture collection, Biotechnology
WDCM, Microorganisms

INTRODUCTION

Microbial Culture Collections have been recognized as vital biological resources that provides both the scientific community and industry with life organisms for educational, research and industrial purposes for over five decades(Danielle et.al.,2010).There are many culture collections set up all over the globe to conserve and preserve microbial diversity on a long term range (Dilip et al.,2005). Advancement of biotechnology from a global perspective depends not only on manpower, infrastructures, fund and equipment. It also depends on biological systems required and utilized. Biological systems such as microorganisms, plants and animals are essential for a successful biotechnology. There is therefore need to adequately preserve these systems. Microorganisms are collected and maintained in culture collections worldwide As at July ,2010, there are only 576 culture collections in 68 countries comprising a total of 1,587,308 microbial of bacteria 46.3%,fungi 31%,viruses 1%, cell lines 0.72% and other microbial 21.7% according to World Data Centre of Microorganisms(WDCM). This paper presents world microbial culture collections in a graphical view for better understanding of the status of culture collections worldwide so as to serve as a challenge to countries with few or no registered cultures.

METHOD

The graphs (pie chart and histogram) presented in this poster were plotted from available data on the website of WDCM as at July 2010 using Microsoft excel 2007. Five continents are represented with 68 countries.

RESULTS AND DISCUSION

Biotechnological advancement is sin qua none to how biological resources are utilized and preserved in each countries. The countries that are developed biotechnologically are found to have registered cultures unlike their counterpart from developing countries expecially.From the results of the pie charts and histogram obtained, it can be seen that Europe has the largest number of countries with registered WDCM cultures. Analysis of the data obtained from WDCM reveals that there are 576 cultures collections from 68 countries and over 1.5 million maintained cultures. 229 are government supported, 54 semi government, 212 universities owned, 15 by industry while 21 are private owned unlike in 2005 where there are 470 cultures collection from 62 countries and over 1.5million maintained cultures. 175 are government supported 54 semi government 149 universities owned, 15 by industry while 21 are private owned. (Dilip et al, 2005). This information shows significant improvement in culture deposition and registration with WDCM. Europe holds the highest percentage 40.23%, America 27.78%, Asia 25.49%, Oceania 5.69%, and Africa 0.79%. However, this was a significant development compared with 5years ago. United State of America alone has 17 times the total number of culture in 7 countries represented from Africa. No wonder, there is little

biotechnology development in the Africa continent. Many factors can be attributed to the reasons for low participation and registration of microbial culture collections in Africa. Lack of fund, infrastructure, inadequacy of necessary equipment, man-power or expertise, political instability, epileptic power supply. These entire factors militate against advancement of biotechnology and Science and technology in general. More efforts need to be put in place in this continent (Africa) in order to be at per with other developed continents. There is no gainsaying that there maybe some culture collections that are not yet registered with WDCM worldwide. This has to be strongly discouraged. There should a global collaboration between countries from developed and developing countries in man power training, exchange programmes and grants to maintain a viable and functional microbial culture collections if biotechnology is expected to circulate round the world

CONCLUSION

A graphical view of culture collections worldwide revealed the importance of culture collection effort of each country and calls for their registration with WDCM from concerned institutions

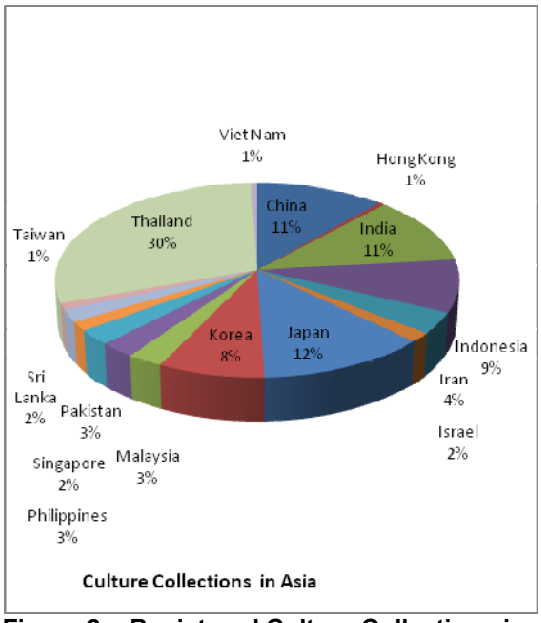


Figure 2a: Registered Culture Collections in Asia. Pie chart

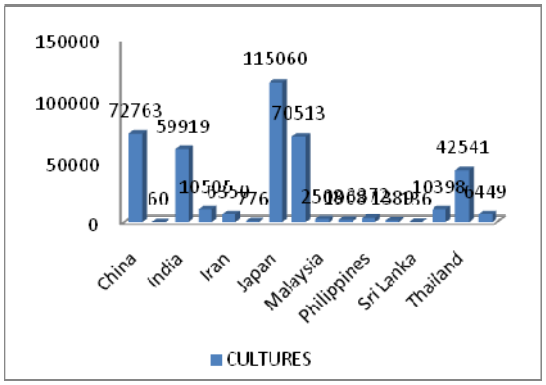


Figure 2b: Registered Culture Collections in Asia. Histogram

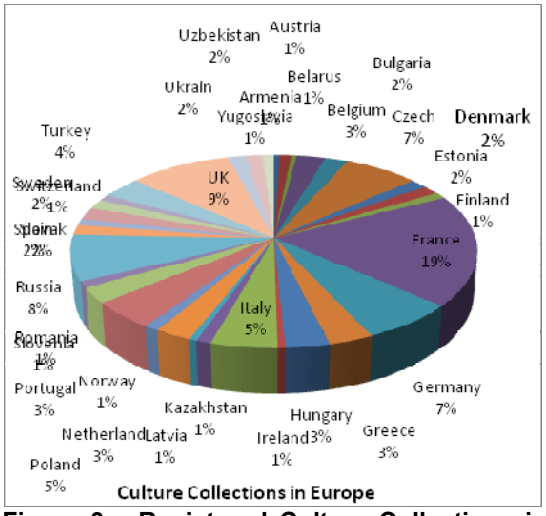


Figure 3a: Registered Culture Collections in Europe. Pie chart

REFERENCES

[1] Dilip A.K, Ratul S., Ram D. & David S (2005).Current status, strategy and future prospect of microbial resource *collections*. *Current sci*, Vol 89, no 3

[2] Danielle J.,David R A ,Chantal B & Esperanza G.,(2010).The role of public biological resource centers' in providing a basic infrastructure for microbial research. *Res in mbiology* doi 10.1016/j.resmic.2010.03.009

[3] www.wdcm.nig.ac.jp

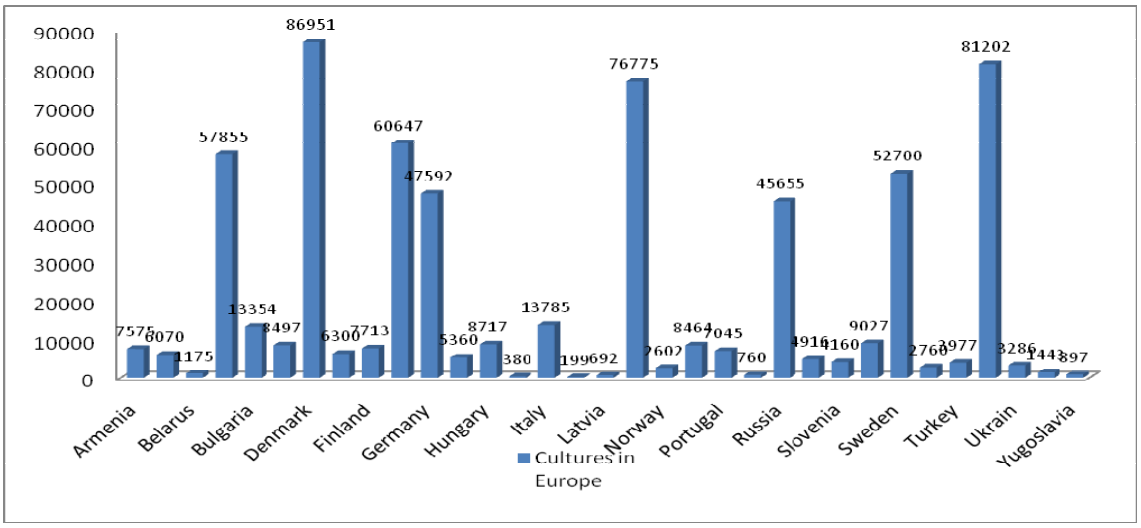


Figure 3b: Registered Culture Collections in Europe. Histogram

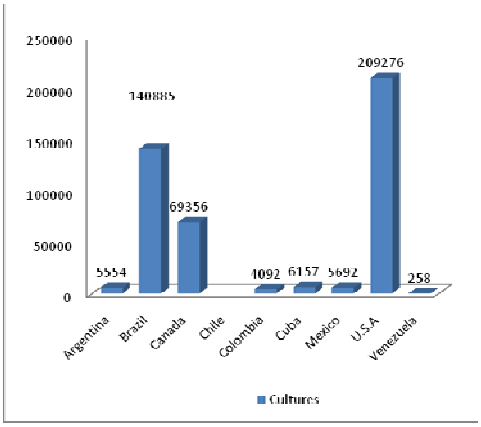


Figure 4a: Registered Culture Collections in America.Histogram

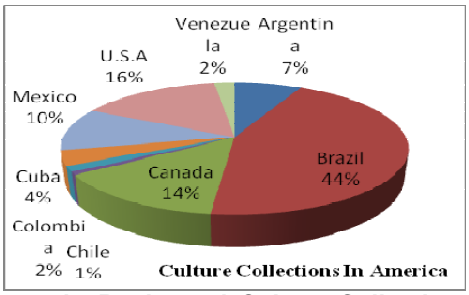
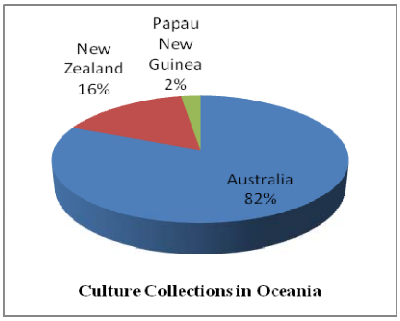
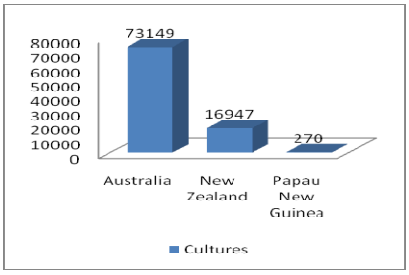


Figure 4b: Registered Culture Collections in America





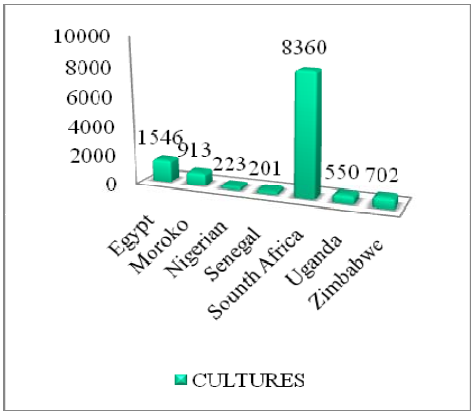


Figure 5b: Registered Culture Collections in Oceania. Histogram

Prevalence of *Escherichia coli* in duck intestines, faeces, soil and wash water samples in Penang, Malaysia

F. Adzitey *[1], H. Nurul[1], R. Gulam[1]
[1]Food Technology Programme, School of Industry Technology, Universiti Sains Malaysia, Minden 11800 Pulau Pinang, Malaysia
*Corresponding author e-mail: Adzitey@yahoo.co.uk

Abstract
This study was conducted to determine the prevalence of E. coli in duck intestines, faeces, soil and wash water samples, in Penang, Malaysia. In all 50 duck intestines, 60 duck faeces, 25 duck soil samples, and 20 duck wash water samples were analyzed. The overall prevalence of E. coli was 79.00%. Of which the prevalence of E. coli was 88.00, 82.00, 72.00 and 50.00% for faeces, intestinal contents, soil and wash water, respectively. E. coli type 0517(198) was more prevalent than 0517:H7 (46). Majority of the E. coli also belong to the biotype 1(106 against 16). This study is to provide baseline information on the distribution of E. coli in ducks, their rearing and processing environments, and indicated that E. coli is widely distributed during these activities. Characterization of these organisms is essential to determine their pathogenicity since pathogenic strains can be life threatening.

Keywords
Ducks, *E. coli*, and Prevalence.

INTRODUCTION

Escherichia coli are Gram negative, facultative anaerobe bacteria that ferment glucose and/or lactose and a member of the family *Enterobacteriaceae* [1]. The organism is widely distributed in the intestine of animals and forms part of the normal intestinal flora that maintains the physiology of a healthy animal [2]. Although many *E. coli* strains are non-pathogenic opportunistic types that cause infections in immunocompromised individuals exist [3]. There are also pathogenic strains that cause gastrointestinal illness in healthy humans when ingested [4]. Symptoms of pathogenic *E. coli* infections include watering diarrhea, little or no fever, bloody diarrhea and hemolytic uremic syndrome [3].

The importance of ducks cannot be over emphasized. Duck farming serves as a source of employment to those who are involved in duck rearing. It provides food in the form of meat or eggs which is a significant source of protein for many people. Live ducks, the meat or eggs can be exported as a source of foreign exchange, to alleviate poverty and promote development especially among rural households. The feathers can be used for decorative purposes. In some places ducks have been used to control water snails [5]. Ducks have advantage over chickens in that they easily adapt to various adverse environments and are resistant to a variety of animal diseases.

Duck production has been practiced for several years. Despite this little attention has been paid to the association between ducks, food-borne pathogens and consequently food-borne illnesses.

Malaysia is the third largest producer of duck meat globally [6]. Suggesting that Malaysia contributes significantly to the total duck meat consumed worldwide and duck production perhaps contributes reasonably to Malaysia's economy. In Malaysia, ducks are normally raised by individuals on commercial or under village conditions; while they are slaughtered by individuals in local or commercial abattoirs. These methods of producing and processing ducks in Malaysia reveal several critical points that could make the product a potential source of food-borne pathogens. This work aimed at describing for the first time in literature the prevalence of *E. coli* in duck intestines, faeces, soil and wash water samples in Penang, Malaysia and to give an idea about the possibility of spreading *E. coli* by ducks to duck meats and other foods.

MATERIALS AND METHODS

Location, duration and data collection

In this study, a total of 155 samples made up of ducks and ducks-related samples were collected aseptically from various commercial local duck farms and abattoirs in a 4 month period in Penang, Malaysia. Duck intestines and wash water samples (water used for washing duck carcasses) were obtained from the local abattoir in the wet market while faecal and soil samples were obtained from the farms. The samples collected were stored under 4^{o}C, transported to laboratory under aseptic conditions and analyzed immediately for the presence of *E. coli.*

Isolation, confirmation and identification of E. coli

Approximately 30 – 50g of intestinal contents, faecal and soil samples were thoroughly mixed and 1g portions transferred into 9ml EC broths. With the wash water samples, 10ml were transferred into 90ml EC broth. EC broths were incubated for 24 ± 2h at 45.5°C. After which about 10ul aliquots of EC broths were streaked onto Levine's eosin-methylene blue and Eosin-methylene blue agars; and incubated for 24 ± 2 h at 37°C. Presumptive *E. coli* colonies appear as dark centered and flat, with or without metallic sheen. Such colonies were purified on plate count agar slants, identified and confirmed using Gram staining, and biochemical tests such as Indole production, Voges-Proskauer (VP), Methyl red and Citrate reactions (popularly known as IMViC reactions). *E. coli* 0157:H7 was determined using the inability of the *E. coli* isolates to ferment sorbitol. Biotype 1 gave ++-- and biotype 2 gave -+-- in the IMViC reation. Thus biotype 2 *E. coli's* are negative for indole production. All media were purchased from Merck, Germany.

RESULTS AND DISCUSSION

The result for the occurrence of *E. coli* in the duck intestinal contents, faeces, soil and wash water samples is presented in Table 1. From table 1, the overall prevalence of *E. coli* was 79.00%. The highest prevalence of *E. coli* was found in the feaces (88.00%), followed by the intestinal contents (82.00%), soil (72.00%) and wash water (50.00%) samples. *Escherichia coli* 0517 was the predominant species 198 against 46 for the 0517:H7 isolates. Out of the 244 biotypes obtained, 212 belong to the biotype 1 and the rest (32) biotype 2.

It was obvious that, the prevalence of *E. coli* was high in the samples examined. Thus healthy ducks like other animals carry *E. coli* in their intestines and consequently shed them during defaecation. Shed *E. coli's* survive well in faeces and soil samples. In duck farms, there is the possibility of *E. coli* being transmitted from one flock to subsequent ones, and to other things in the farm such as feed and drinking water. Under transportation conditions ducks may continue to share *E. coli's* through their faeces, and consequently cross-contamination can occur. *Escherichia coli* may end up in the abattoir from contaminated crates and birds, and under poor processing conditions they will infest dressed duck carcasses. We found some *E. coli's* in the wash water sample. The probable source may be from the intestines which might have raptured during carcass processing, the faeces during dressing or from the skin when carcasses were being washed. Processing procedures therefore expose duck meat samples to *E. coli* and can cause contaminations and/or cross-contaminations to other food products. This study is particularly important because we isolated 46 *E. coli* 0517:H7 which suggests that pathogenic or diarrheagenic *E. coli's* may be present in the duck samples we analyzed and subsequently a threat to public health. Feng and Weagant [3] indicated that, the analysis for pathogenic *E. coli* requires that the isolates should first be identified as *E. coli* before testing for their virulence markers. The pathogenic groups includes enterotoxigenic *E. coli* (ETEC), enteropathogenic *E. coli* (EPEC), enterohemorrhagic *E. coli* (EHEC), enteroinvasive *E. coli* (EIEC), enteroaggregative *E. coli* (EAEC), diffusely adherent *E. coli* (DAEC) and others that are not yet well characterized [4]. Of these, only the first 4 groups have been authentically implicated in food and water-borne illnesses [3] and O157:H7 is the prototypic EHEC most often implicated in illness worldwide [4, 7, 8].

CONCLUSION

In general, the prevalence of *E. coli* in the samples analyzed was relatively very high. It ranged from 50.00 to 88.00%. Most of the *E. coli* isolates were of the type 0157 which are usually non-pathogenic and belong to the biotype 1. Duck faecal samples showed the highest prevalence while wash water samples showed the least. The isolation of *E. coli* in the wash water samples indicate faecal contamination and unsanitary processing of ducks in local duck abattoirs in the study area.

RECOMMENDATIONS

It is recommended that further research is carried out to characterize these *E. coli* isolates since pathogenic strains can be present and consequently concern for public health. Processers of duck meat in local abattoirs in Malaysia should observe more hygienic practices in processing ducks.

ACKNOWLEDGMENTS

This research was supported by the Postgraduate Research Grant Scheme (1001/PTEK1ND/843007) of the Universiti Sains Malaysia. The first author is also grateful to IPS-USM for the support being given to him in the form of USM fellowship to pursue his PhD education and the funding to participate in this conference.

Table 1: Occurrence of *E. coli* in duck intestinal contents, faeces, soil and wash water samples

Duck sample	No. tested	No. positive	% prevalence	*Escheria coli* type		Biotype	
				0157:H7	0157	Type 1	Type 2
Intestinal content	50	41	82	32	50	50	32
Wash water	20	10	50	2	18	20	0
Faeces	60	53	88	8	98	106	0
Soil	25	18	72	4	32	36	0
Overall	155	122	79	46	198	212	32

REFERENCES

[1] Ewing, W.H., Edwards and Ewing's Identification of *Enterobacteriaceae*, 4th ed., Elsevier, New York (1986).

[2] Conway, P.L., Microbial ecology of the human large intestine. In: G.R. Gibson and G.T. Macfarlane, eds., Human colonic bacteria: role in nutrition, physiology, and pathology. CRC Press, Boca Raton, FL (1995) p 1-24.

[3] Feng, P., Weagant, S.D., Bacteriological Analytical Manual, 8th ed., Chapter 4 (2009).

[4] .P. Nataro, J.B. Kaper, Diarrheagenic *Escherichia coli. Clin. Microbiol. Rev. 11: (1998) 132-201.*

[5] A.U. Gallebu, P.C. Jover, F.F. Bongolan, Integration of ducks to lowland culture as biological control of the golden apple snail. *Philippine J. Crop Sci. 17 (1992). Suppl. 1, p. 27.*

[6] FAO. FAOSTAT on Main producer country of duck meat in 2007. Downloaded from: http://faostat.fao.org/site/569/DesktopDefault.aspx?PageID=569#ancor (2009).

[7] CDC, Centers for Disease Control and Prevention. Update: Multistate outbreak of *Escherichia coli* O157:H7 infections from hamburgers-Western United States, 1992-1993. *Morbid. Mortal. Weekly Rep. 42(1993) 258-263.*

[8] P.M. Griffin, R.V. Tauxe. The epidemiology of infections caused by *Escherichia coli* O157:H7, other enterohemorrhagic *E. coli* and the associated hemolytic uremic syndrome. Epidemiol. Rev. 13(1991) 60-98.

Dualband Slotted Planar Antenna for RFID Application

N.M.Nor[1], I.M.Ibrahim[1], M.K.Suaidi[1], M.Abu[1]
[1] Centre for Telecommunication Research and Innovation,
Faculty of Electronic and Computer Engineering
Universiti Teknikal Melaysia Melaka,
norazura.mdnor@yahoo.com, imranibrahim@utem.edu.my, kadim@utem.edu.my,
maisarah@utem.edu.my

Abstract
A slotted planar antenna with dual operating frequency of 860MHz – 960MHz (UHF band) and 2.45GHz (ISM) is proposed for RFID reader application. To communicate with different frequency band tags , the RFID system requires a separate set of antennas for reader application. Therefore, this antenna is design to reduce the set of antenna in RFID system. This antenna has low profile, lightweight and is easy to be fabricated and has successfully demonstrated multiband and broadband characteristics.

Keywords:
Dual band; RFID; Planar Antenna; Ultra High Frequency

INTRODUCTION

It is well known that patch antennas offer many advantages such as low profile, light weight, conformability, etc. However, conventional patch antennas have major weaknesses of narrow bandwidth and low gain [1]. Modern telecommunication systems require antennas with wider bandwidth and smaller dimensions than conventionally possible. Reader antenna is one of the important components in RFID systems, which is used to transmit or receive signal between a tag [2]. Most RFID systems operate at ISM frequencies, such as 13.56MHz, 2.45GHz and 5.8GHz, some work at UHF frequencies such as 840~845MHz, 920~925MHz (China), 952~954MHz (Japan), 868~870MHz (Europe) and 902~928MHz (USA) [3], etc.

In order to communicate with tags from different countries, several techniques, such as using thicker substrates [4], resonant aperture [5], coupled resonators [6], or reactive loading [7], have been recommended to broaden the antenna bandwidth or obtain dual-band operation. The dual band characteristic of the proposed antenna is achieved by incorporating another slot to the single slot. The center frequencies of these bands are controlled by the electrical length of these slots. In the absence of a complete analytical approach for the design of such an antenna configuration with slots, parametric studies are conducted to arrive at the desired performance.

ANTENNA DESIGN

The dimension of the slotted planar antenna is 120 x 85 mm^2, printed on substrate FR4 with thickness of 1.6 mm and relative permittivity 4.7. The dimension of the slot a and b is 1.1 x 15.25 mm^2. The dimension of the slot c is 2.5x 26mm^2. The dimensions of step a and step b are 4 x 18mm^2 and 3 x24 mm^2, respectively.

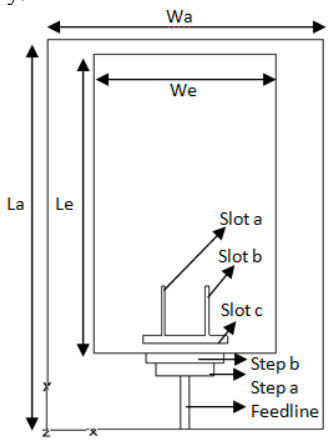


Figure 1(a): Front view simulation design of proposed antenna

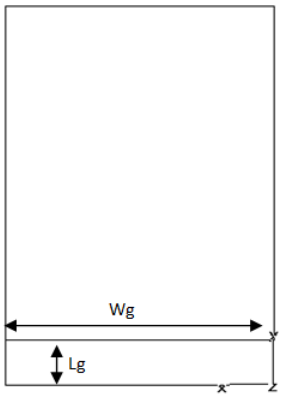


Figure 1(b): back view simulation design of proposed antenna

The antenna has the following facet: Wa = 85mm, La =120mm, We = 56mm, Le =92mm and Lg= 14mm. The excitation is a 50Ω microstrip line printed on the partial grounded substrate.

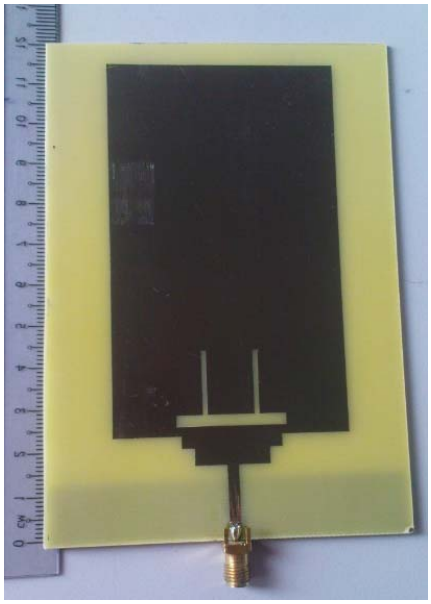


Figure 2 (a): Front view of fabricated antenna design

Figure 2(b): Back view of fabricated antenna design

RESULT

A. Return loss

The simulated return loss of the proposed antenna is depicted in Figure 3. The antenna simulation result obtained for 910MHz and 2.45GHz are -14.45dB and -19.74dB for return loss respectively using the commercially available simulation software CST Microwave Studio. A good impedance bandwidth of 208MHz has been achieved form 822MHz to 1.03GHz for the lower band, while the upper band covers 58MHz (from 2.41GHz to 2.47GHz) for simulation result.

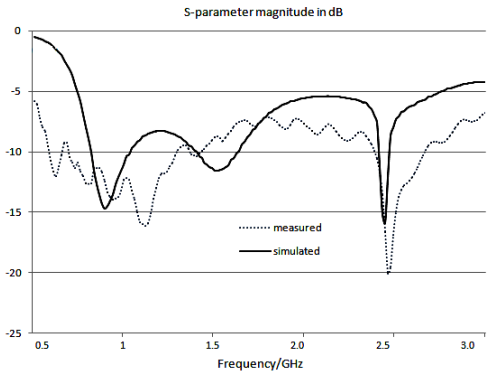


Figure 3: Simulated and measured return loss

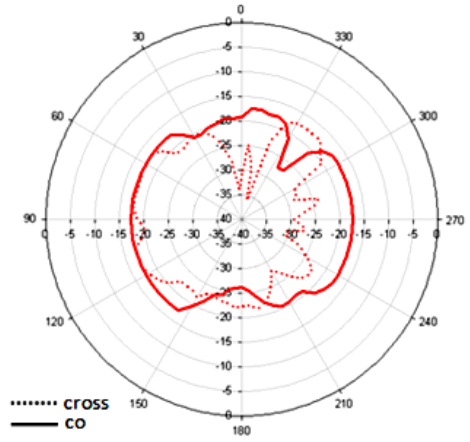
However for measured result, better impedance bandwidth of 582MHz is obtained from 704MHz to 1.29GHz for lower band and 250MHz from 2.4GHz to 2.65GHz for upper band. The measured return loss obtained for 910MHz and 2.45GHz are -13.45dB and -18.65dB. Parametric studies have been performed to facilitate more elaboration of the design and optimization processes for readers. Various parameters are investigated to examine the effects of the antenna parameters on return loss as well as the impedance bandwidth of the antenna.

B. Radiation pattern

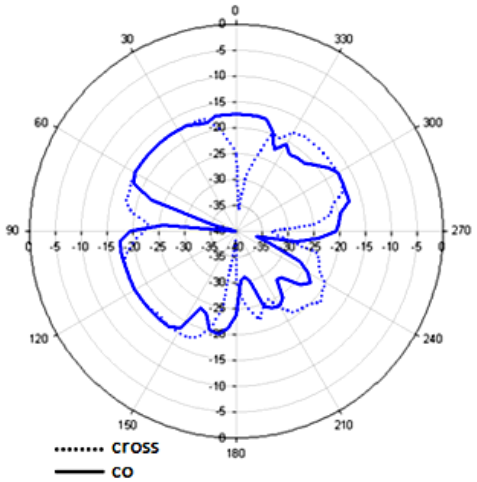
The radiation characteristics of the opening frequency within the antenna bandwidth are also investigated. Antenna radiation patterns are graphical representations of the distribution of radiated energy as a function of direction about an antenna. Typical patterns in two orthogonal planes at the two resonant frequencies are presented in figure 4 (a) and 4(b) for measurement result.

The measured designed antenna produce broadside or Omni directional radiation pattern with maximum gain of 1.65*dBi* at *f*=910MHz and of 2.11*dBi* at *f*= 2.45GHz. It is seen that good broadside radiation characteristics with the same polarization planes are obtain, and the cross-polarization radiation is well below -15dB. The measured results agree with the simulated result.

Figure 4(a) presents the measured *y-z* plane radiation pattern at the centre frequency *f*=2.45GHz. The cross-polarization level for the *y-z* plane is less than approximately -15dB in the same frequency. Figure 4(b) shows the measured *x-z* plane radiation pattern at the centre frequency. The cross-polarization level for the *x-z* plane is less than -15dB. The proposed antenna shows stable radiation characteristics for the frequencies of interest.



(a)



(b)

Figure 4: Measured result y-z plane (a) and x-z plane (b) radiation pattern of 2.45GHz.

CONCLUSION

A slotted planar antenna with multiband and broadband characteristics has been successfully demonstrated. Multiband characteristics of proposed antenna are also observed. The antenna is compact, simple to design and easy to fabricate. A moderate gain is achieved. The measured impedance bandwidth for 1:2 VSWR of the designed antenna at the UHF band reaches 64.39% (704MHz~1.29GHz) and 10.2% (2.40GHz ~ 2.65GHz) at the microwave band.

ACKNOWLEDGEMENT

This work is financially supported by Universiti Teknikal Malaysia Melaka under PJP/2009/FKEKK (2D) S538 funding

REFERENCES

[1] Wong K.L., Compact and Broadband Microstrip Antennas, John Wiley and sons Inc., New York, NY 2002.

[2] Klaus Finkenzeller. RFID Handbook: Fundamentals and Applications in Contactless Smart Cards and Identification, 2nd Edition, (2nd edition) Wiley, 2003.

[3] Harvey Lehpamer. RFID Design Principles. Artech House, Inc., 2008.

[4] Chen, W., Lee, K.F., and Lee, R.Q.: 'Input impedance of coaxially fed rectangular microstrip antenna on electrically thick substrate', Microw. Opt. Technol. Lett., 1993, 6, (6), pp. 387–390.

[5] Targonski, S.D., Waterhouse, R.B., and Pozar, D.M.: 'Design of wideband aperture-stacked patch microstrip antennas', IEEE Trans. Antennas Propag, 1998, 46, (9), pp. 1245–1251.

[6] Croq, F., and Pozar, D.M.: 'Multifrequency operation of microstrip antennas using aperture coupled parallel resonators', IEEE Trans. Antennas Propag, 1992, 40, (11), pp. 1367–1374.

[7] Nakano, H., and Vichien, K.: 'Dual-frequency square patch antenna with a rectangular notch', Electron. Lett. 1989, 25, (16), pp. 1067–1068.

Temperature Analysis on Bi-fuel Single Cylinder Engine Fueled by Petrol & LPG

I. Meran*, M. S. G. Herawan, Y. Sulaiman and M. R. Ayob
Faculty of Mechanical Engineering, Universiti Teknikal Malaysia Melaka,
Locked Bag 1752, Pejabat Pos Durian Tunggal, Melaka.
Phone: +6013-6241058
*E-mail: is_crosfire85@yahoo.com

Abstract
In this study, characteristics on single piston spark ignition (SI) internal combustion engine (ICE) operated with unleaded petrol (ULP) and liquid petroleum gas (LPG) has been compared. In particular, temperatures were examined using thermocouple and the fuel consumption was examined using precise Pierburg PLU 401 device, while gaseous fuel consumption was registered by a tensometric. The purpose in temperature test is to identify which fuel can contribute damage on engine component. Result show that SI engine fueled by LPG produce more heat compared ULP. Temperature output from engine fuel by LPG and ULP is 510°C and 435°C respectively. However SI engine fueled by LPG require more fuel to reach certain RPM due to the LPG energy content per volume.

Keywords
Single cylinder Engine, temperature, fuel consumption, LPG, ULP.

INTRODUCTION

Liquefied petroleum gases (LPGs) are by-products of natural gas production and crude oil refineries. It consists of propane or butane or mixtures of both. Propylene and butylenes are usually also present in small concentration. A powerful odorant, ethanethiol is added, so if there is a leak on the container (tank) it can be easily detected. It is generally accepted that the emission form a LPG powered vehicle are less than those from the ULP fuelled equivalent. Result from corroborated by Klausmeier and Billick [4] and Wu et al. [5] Newkirk et al.[6] presented measured data showing that NOx emission from LPG fuels are lower compared to ULP. One such study by Snelgrove et al. [3] state that hydrocarbon (HC) emission were reported as 40% lower, carbon monoxide (CO) as 60% lower and carbon dioxide (CO2) as subtantialy reduced, principally due to high hydrogen/carbon ratio of LPG when compared to ULP. Temperature produce due to the combustion of fuel in internal combustion engines may contribute damage to the engine component. Since the conventional engine was dedicated to run on ULP or diesel still facing problem impact from heat release due to combustion. It is not possible that engine fueled by LPG can contribute damage to the engine component. In the combination with efficient powertrain and engine technologies, the potential of LPG is excellent for comparably light and cost effective in reduction of CO2 and toxic emission in the future. As the LPG fuelling stations are not familiar in Malaysia, so it's far widespread enough to make a dedicated LPG vehicle practical, it results necessary to start with proposing alternatively LPG powered engines. Such a bi-fuel automotive engines are necessary to bridge the gap between ULP and LPG. The important characteristics of LPG on vehicle are, LPG has higher octane number of about 112, means it enables higher compression ratios to be employed and gives more thermal efficiencies. Due to gaseous nature of LPG, smoother acceleration and idling performance is achieved. Fuel consumption is increase as compared to ULP and this is due to the energy content per volume. Power output is reduced in LPG operation as compared to ULP [3]. LPG system on vehicle requires more safety because LPG is the gaseous fuel. LPG engines have good durability and good cold start performance [1-2]. Hence liquefied petroleum gas is a versatile form of energy that can be used for many areas. Unlike other conventional fossil fuels, LPG is not only cleaner but also less harmful to the environment. LPG is not just about cleaner fuel but it also good in performance. One of the technologies that have been develops by Australian LPG Warehouse, where the liquid LPG is injected into behind of intake valve show the improvement in performance of engine fuel by LPG. SI engine fueled by LPG can allow higher compression ratio due to the research octane number (RON) contain on the LPG up to 112 for pure propane. Considering on the engine power output, emission and fuel cost, LPG fuel was expected to have market potential as the alternative fuel for vehicle. As the price of petroleum in the automotive industry continues to rise, converting to LPG is a wise decision. To achieve the optimal performance and maximum environmental benefits of LPG, technological advancements must continue to reduce the costs of dedicated vehicles to be competitive with conventional vehicles.

CONVERSION

The Automotive industry is very slow in reacting to the depleting supply of crude oil which tenders for commercializing of new automotive technology fueled by alternative energy sources. This is unlikely to change in the near future since the industry's

objective is not about a greener world but based on supply and demand with profit at its centre. Nobody seems to take the first step to revolutionized the industry. The only feasible change will be a gradual conversion. This is where LPG is most versatile fuel available. It can be used with existing fuel system (bi-fuel) and fully functional on is own. Almost negligible alteration is required. Currently a number of automotive petrol vehicles have been fitted with LPG system by researchers at the current university. The vehicles are classified as bi-fueled. Results have shown significant cost savings. On road test runs have shown that the vehicle is capable of running on LPG alone without the use of petrol. Such system is necessary to bridge the gap between the current petrol driven vehicles and fully LPG vehicles. Widespread LPG refueling stations need to be constructed to promote its widespread application. Another popular mode of transport is the motorcycle fueled by petrol. It is therefore inherent that the technology is developed and its use be promoted alongside the LPG automotive conversion. This paper introduces initial results of the ongoing study of LPG fueling system for petrol driven engines. This paper presents the experimental test results of one particular engine namely, the Modenas Kriss 111 cc single cylinder engine.

EXPERIMENTAL SETUP

Experiment was carried out on a single cylinder Modenas Kriss. Engine specifications are tabulate on Table 1.

Table 1: Specification of tested engine

Criteria	Description
Type	Four-stroke, spark ignition, single cylinder, SOHC
Displacement	111 cc
Compression ratio	9.3 : 1
Carburetor	KEIHIN PB18
Ignition system	Magneto to CDI
Cooling system	Air cooled
Bore x stroke	53.0 mm x 50.6mm
Spark plug	NGK C6HAS

In this experiment the LPG vaporizer was replace with LPG valve capsule (Figure1) where the function of the vaporizer still exist on this devices but without heating element just like current vaporizer apply. LPG valve capsule also reduce weight and space usage. Ignition spark timing remains same for both mode series. The reason to leave the ignition spark timing remains same for both mode series is because the interest is to analyze the characteristics of the single cylinder engine with standard manufacture setting when fueled by ULP and LPG

Figure 1: LPG valve capsule

Table 2: Thermocouple location attach on engine

Channel	Location
1	Intake air on carburetor
2	Intake manifold
3	Engine block
4	Exhaust
5	Lubricant oil
6	LPG valve capsule inlet
7	LPG valve capsule outlet
8	Ambient

In order to attach thermocouple to the engine, soft abrasive paper (grade: 500) was applied to remove paint, rust, or any particle that prevent thermocouple from directly contact to the surface to be tested. After that apply solvent (turpentine) in order to remove any dirt on the component surface and leave it to dry about 30 minutes. Thermocouple was attached to the specific location (Table 2) with using Silicaflex™ Tape AB by Insulflex. For measuring the lubricant oil temperature, small hole was made to the lubrication pipe on the engine. Thermocouple was fill in the small hole and seal with epoxy from Selleys. Leave the epoxy to dry and reach it full strength for 24 hour then wrap with Silicaflex™ Tape AB. For the exhaust, thermocouple was clamped with using stainless steel pipe clamp 30mm in diameter and wrap using Silicaflex™ Tape AB. The layout of the experimental setup is shown in Figure 3. Thermocouple type K were used and connected to the PICO USB TC-08 thermocouple data logger.

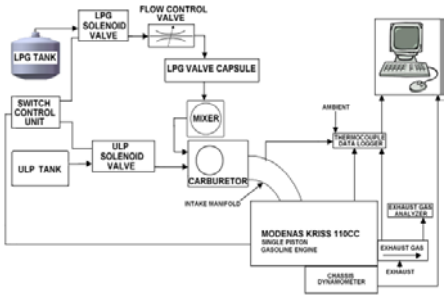


Figure 2: Experimental lay-out

EXPERIMENTAL PROCEDURE

Engine was tested on control environment to minimize correction factor. Data was obtained under

stabilized operating conditions with adequate fresh air supply to engine. Temperature of the inlet air to the engine was measured within 0.30 m upstream of air inlet ductwork. Engine was warm up for five minutes in idle condition and no data was taken until temperatures were maintained constant for one minute. Test engine were analyze on engine speed 2500rpm with no loads. First series featured engine running on ULP, while the second one was registered for LPG operation. Fuel consumption was measured respectively for petrol with the use of precise Pierburg PLU 401 device, while gaseous fuel consumption was registered by a tensometric balance. All tests completed on the Modenas Kriss 110cc engine were done for stochiometric mixtures being increase to 16.56 for LPG mode series and with ignition spark timing remain same for both series. In examine the fuel consumption the test engine was run on variety of engine speed from 1000rpm to 5000rpm. Engine was warm up for five minute and no data was recorded during warm up.

RESULTS AND DISCUSSION

Figure 4 shows the temperature on the exhaust of engine fueled by ULP and LPG. As liquid fuels have latent heat of vaporization, they also act as a cooling agent on intake charge during vaporization.

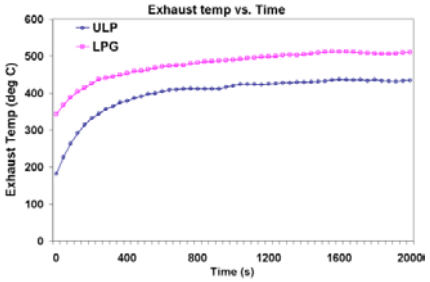


Figure 3: Exhaust Temperature versus Time

Therefore, ULP enters the combustion chamber as vapor, there will be an increase in intake mixture density and consequently in volumetric efficiency, but gaseous fuels which are vapor in ambient temperature, not only have no cooling effect, but also be a factor in decreasing the volumetric efficiency, due to larger volume of fuel in inlet mixture [8]. Engine fueled by LPG need to use high quality exhaust valve where it can work on high temperature. Conventional exhaust valve was dedicated to work on ULP fuel so if the engines were fueled by LPG, exhaust valve could experience damage which is broke or bend. Engine piston also face the same situation where temperature is direct proportion to pressure, in other word if the temperature rise, pressure will experience the same thing, pressure rise. As the pressure and temperature rise engine piston have a chance to fail. As the engine piston and/or exhaust valve fail, the other engine component which is engine block, cylinder head, connecting rod and ball bearing will fall into damage. If lucky, damage will vine until drive train and if that happen, it can endanger motorcycle rider. Other component damage that cause from high temperature is leak, seal like O ring, gasket and oil seal can melt if expose to the high temperature with long period and of course leakage happen.

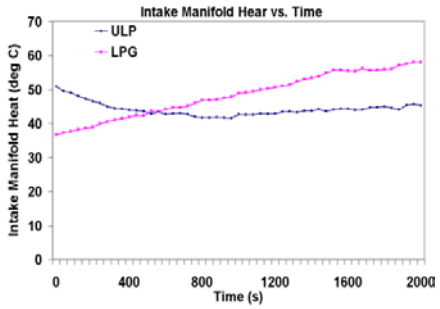


Figure 4: Intake Manifold Heat vs. Time

As the LPG fuel has no cooling effect, this can be proving with referring to the intake manifold temperature (Figure 5). Engine where in idling condition, speed around 1000rpm to 1100rpm, fuel enter the combustion chamber are just a small amount and at the same time fuel should flow into the intake manifold before enter the combustion chamber. In idle condition the cooling effect from the ULP fuel is less while gaseous fuel as describe before, the heat is almost totally discharge to the exhaust. When the engine is running on high speed, more fuel was entering the combustion chamber so the liquid fuel play they role to be the cooling agent. That's one of the advantage of using liquid fuel, while gaseous fuel has no cooling effect and much fuel enter the combustion chamber, so the temperature of the intake manifold is accelerate increase.

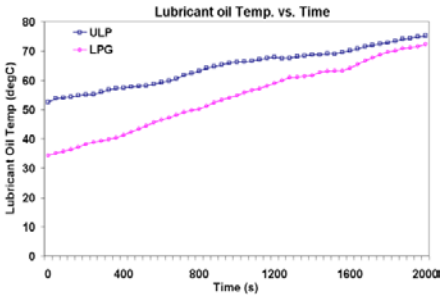


Figure 5: Lubricant oil temperature vs. Time

As the engine is warming up on idle condition where engine speed is about 1000rpm to 1100rpm, lubrication oil doesn't absorb much the heat release due to the combustion of LPG fuel. This phenomenon could be due to the density of the LPG, where LPG burn in combustion chamber as gas and the heat produce and combustion product is easily discharge to the exhaust. Maximum temperature of the lubricant oil is about 80°C for both modes. Lubrication oil not just only acts as the lubricant, it also works as the cooling agent to the engine. As the engine was cooling by air, to get the benefit from lubrication oil

as cooling agent from lubrication oil, aluminum oil cooler can be use where it act as heat exchanger as radiator works from vehicle that cooled by water.

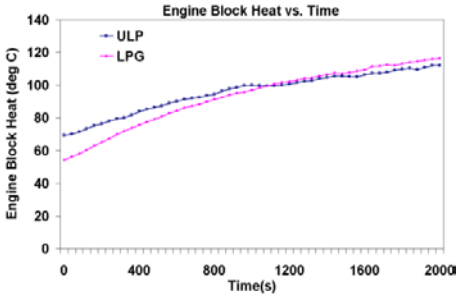


Figure 6: Engine Block Heat vs. Time

Engine block was designed with using material that can absorb heat and release to the ambient through the cooling fin provided. But if the temperature is too high, engine piston will expand and finally get stuck inside the engine block. If that happen, engine may stop running.

Analysis on fuel consumption as shown on Figure 6 determine that on LPG mode, engine use more fuel compared to ULP. On fuel consumption vs. engine speed curve it shown that LPG engine fueled by LPG used more fuel on every engine speed compared to ULP on average 15% from overall engine speed. This phenomenon occur because of the properties of the fuel it self, where LPG has a lower energy density than ULP by volume, so it need more fuel to compete with ULP in order to reach certain rpm.

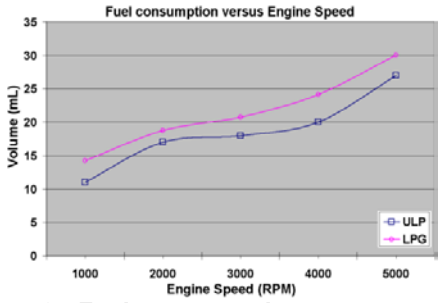


Figure 6: Fuel consumption versus engine speed

As the engines fueled by LPG require more fuel in order to reach certain engine speed (rpm), it doesn't tell us that LPG is not efficient. LPG is the efficient fuel for vehicle, where LPG has a higher energy density by weight; therefore, the weight of a tank full of LPG is similar to that of one filled with ULP [8]. LPG has higher energy content by weight, so it can take a vehicle farther on an average-capacity tank than a similar tank of ULP fuels.

CONCLUSION

Temperature and fuel consumption characteristics of a single cylinder four-stroke motorcycle engine were experimentally measured when fueled by petrol and liquid petroleum gas. Liquid petroleum gas which is investigated in this paper has a common property that contributes to the some advantages and disadvantages relative to the conventional liquid fuels which is petrol. Petrol has a cooling effect that can absorb engine heat while LPG as a gaseous fuel not just only have no cooling effect but it also reduce the volumetric efficiency. Due to the high temperature of the engine, damage can occur to the engine component. As the engine fueled by LPG, engine component that expose to the high temperature during combustion should be replace with high performance part. In order to overcome over heat problem, engine that cooled by air can apply the heat exchanger to the lubrication oil. LPG is the efficient fuel to the engine due to the high energy content by weight, where it can go much further compared to the engine fueled by ULP.

ACKNOWLEDGEMENT

I would like to thanks to my entire supervisor for his guidance on completing this project not forget to the technical staff from Universiti Teknikal Malaysia Melaka for their opinion, suggestion and cheering me.

REFERENCES

[1] K. Owen, T. Coley. Automotive Fuels Reference Book, second ed., ISBN: 1560915897 (1995).

[2] Autolocate, 2003. Available from <http://www.autolocate.co.uk/features/lpg>.

[3] D.G. Snelgrove, P. Dupont, R. Bonetto. An investigation into the influence of LPG (Autogas) composition on the exhaust emissions and fuel consumption of 3 bi-fuelled renault vehicles, SAE 961170. (1996).

[4] R.F. Klausmeier, I.F. Billick. Comparative analysis of the environmental impact of alternative transportation fuels, Energy & Fuels 7 1–2, ISSN 0887-0624. (1993).

[5] D.Y. Wu, R.D. Matthews, J. Zheng, K. Shen, J. Chiu, C. Mock, S. Jaeger, Texas Project: Part 3—cycle emissions of light-duty vehicles operating on CNG, LPG, Federal Phase 1 reformulated gasoline and/or low sulphur certification gasoline, vol. 1208, SAE Special Publications, pp. 385–414. (1996).

[6] M.S. Newkirk, L.R. Smith, M.E. Payne, J.S. Segal. Reactivity and exhaust emissions from an EHC-equipped LPG conversion vehicle operating on butane/propane fuel blends, vol. 1208, SAE Special Publications, pp.195– 206. (1996).

[7] Material Safety Data Sheet for Silicaflex™ Tape AB, (2008).

[8] Michelle Heath 2008, "Alternative fuels for vehicles", in AccessScience@McGraw-Hill, http://www.accessscience.com, DOI 10.1036/1097-8542.757512 (2008).

[9] Ali M. Pourkhesalian, Amir H. Shamekhi, Farhad Salimi. Alternative fuel and gasoline in an SI engine: A comparative study of performance and emissions characteristics. Elsevier, Fuel vol. 89 pp. 1056 – 1063. (2009).

Potential Anticancer Agent Derived From Methylbenzoylthiourea Derivatives

Rabia'tun Hidayah Jusoh[1*], Wan Mohd Khairul Wan Mohamed Zin[1], M. Sukeri M. Yusof[1] & Bohari M.Yamin[2]

[1]*Department of Chemical Sciences, Faculty of Science and Technology, Universiti Malaysia Terengganu, 21030 Kuala Terengganu.*

[2]*School of Chemical Sciences and Food Technology, Universiti Kebangsaan Malaysia, 43650 Bangi, Selangor, Malaysia.*

**Corresponding author's email: rhidayah@ymail.com*

Abstract

*The synthesis, structure analysis, spectroscopic properties and cytotoxic assay on twenty-eight new ligands, methylbenzoylthiourea derivatives and one complex have been successfully developed and prepared ranging from weak to good yields (24-85 %). The synthesised title compounds were then characterised by usual spectroscopic and analytical methods namely Fourier Transform Infrared (FTIR), UV-Visible analysis, ^{1}H and ^{13}C Multi-nuclear Magnetic Resonance (NMR), CHNS elemental analysis and melting point analysis. In addition, twelve molecular structures of the compounds synthesised were confirmed by using single crystal X-ray diffraction method. From the cytotoxic assay study, the title compounds were evaluated for in vitro cytotoxicity against HL60 and MCF-7 cancer cell lines. Compounds **L15** and **L17-L19** were found to be the most active from these series which has shown inhibition against HL60 cells in the range at 2.5-6.0 μg/ml, respectively. A new copper(II) complex derived from N-(4-methylbenzoyl)-N'-(2,4-dimethylphenyl) thiourea exhibited moderate cytotoxic potency against MCF-7 cancer cells tested at the 14 μg/ml concentration.*

Keywords

Methylbenzoylthiourea, spectroscopic studies, crystal structures, cytotoxicity test, anticancer agent.

INTRODUCTION

Thiourea derivatives have attracted considerable attention due to their coordination ability to transition metal ions. Nowadays, the structural features transition metal complexes of thiourea derivatives have shown to posse a wide range of biological activities such as anticancer, antifungal, antibacterial, anti-HIV.[1-4] Many copper(II) complexes exhibit biological activity due to their chelating ability and positive redox potential. Recent research suggests that copper could be used as a novel selective target for cancer therapies.[5] For instance, copper(II) complexes of acylthiourea derivatives were found to exhibit as antitumor agent.[6]

In the present work, the synthesis and characterisation of 2, 3 and 4-methylbenzoylthiourea derivatives ligands, $R_1PhC(O)NHC(S)NHR_2$ **(L1-L28)**, and one designated complex **D1** were carried out**.** In turns, the preliminary cytotoxicity screening against HL60 and MCF-7 cancer cell lines using MTT assay at 72 hours of exposure was carried out. Variation of the R_1 and R_2 groups attached to the phenyl rings and terminal of nitrogen atom in these molecules include electronic properties of complexes may have influence the cytotoxicity effect.

METHODOLOGY

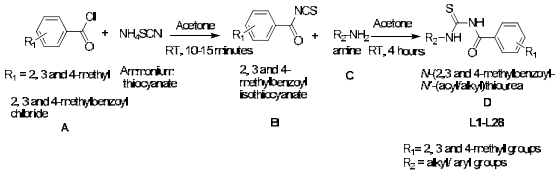
Physical Measurements

All reactions were carried out under an ambient atmosphere and no special precautions were taken to exclude air or moisture during work-up. All chemicals were purchased from Sigma Aldrich or MERCK and used as received without further purification. Infrared spectra of the synthesised compounds were recorded from KBr pellets using FTIR Perkin Elmer 100 Spectrophotometer in the spectral range of 4000–400 cm^{-1}. UV-vis spectra were recorded in 1 cm path length quartz cell with the Shimadzu UV-vis spectrophotometer 1601 series and the Carry Varian 100 conc. UV-vis spectrophotometer at wavelength of 800 nm to 200 nm in MeOH and DCM as solvent. ^{1}H 400.11 MHz and ^{13}C 100.61 MHz NMR spectra were recorded using Bruker Avance III 400 Spectrometer in DMSO-d_6 as solvent and internal standard at room temperature in the range between δ_H 0–15 ppm and δ_C 0–200 ppm. Room temperature diffraction data for selected compounds were collected on a Bruker SMART APEX 4 K CCD diffractometer (Mo Ka radiation, k = 0.71073 Å). Meanwhile, C, H, N, and S microanalysis was carried out with FLASH EA 1112 CHNS-O analyzer. Melting points were determined by Melting point apparatus SMP3.

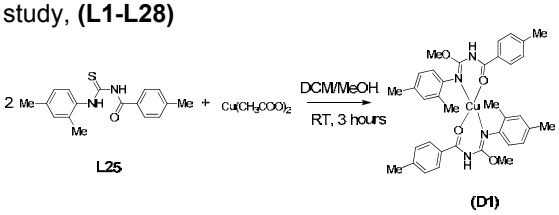
*General Procedure for the Synthesis of Methylbenzoylthiourea Derivatives **(L1-L28)** and Complex* **(D1)**

In this study, 2, 3 and 4-methylbenzoyl chloride were used as precursor and the reaction was carried out at reflux condition at ambient environment in acetone as solvent with ammonium thiocyanate and various chosen amines for each reaction. The crude product

was purified by recrystallisation and/or flash chromatography. The complex **D1** was obtained by adding 2 mol equivalents of **L25** in dichloromethane (40 ml) to a solution of Cu(II) acetate in 50 ml methanol. The reaction was slowly put at reflux with constant stirring at room temperature for *ca.* 3 hours. Reaction progress was monitored by TLC (Hexane: ethyl acetate; 7:3). When adjudged completion, the solvent was removed *in-vacuo* and followed by recrystallisation from dichloromethane: methanol (1:3) to afford dark green solid crystals. The crude product was purified by preparative TLC (hexane: acetone; 70:30) and the dark green band was collected, and recrystallised from methanol to afford the title compound as dark green (0.16 g, 24 %). The synthetic route is shown in **Scheme 1** and **2**.



Scheme 1. Synthetic approach adopted in this study, **(L1-L28)**



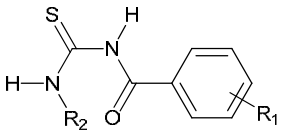
Scheme 2. Synthesis approach the formation of **D1** complex

General Procedure for the In Vitro Cytotoxic activities (MTT Assay)

In vitro cytotoxicity was determined using a standard MTT assay as described previously by Mossamann, 1983.[7] Briefly, 50 µL of RPMI 1640 media (Sigma USA) with 10% of fetal bovine serum (FBS) was added into all the wells except row A in the 96-well plate (BD, USA). Then, 50 µL of diluted compounds at 60 µg/ml was added into row A and row B. A series of twofold dilution of compound was carried out down from row B until row G. The H row was left untouched and the excess solution (50 µL) was discarded. Next, 50 µL of cells (HL60) with the concentration of 2 x 10^5 cells/ ml was added into all wells in the 96-well plate and incubated at 37°C, 5% CO_2 and 90% humidity for 72 hours. After the incubation period, 20 µL of MTT (Sigma USA) at 5 mg/ ml diluted in phosphate buffered saline (PBS) was added into each well in the 96-well plate and medium with MTT was removed from every well and 100 µL DMSO (Sigma, USA) was added to each well with contain the designated compound and solubilize the formazan crystal by incubating for 20 minutes at 37°C, 5% CO_2 incubator. Finally, the plate was read at 570 to 630 nm by using ELISA plate reader (Tecan infinite M200, Austria). The MTT assay experiment was also run in the same manner above for human breast cancer cells MCF-7.

RESULTS AND DISCUSSION

The IR spectra show the compounds' functional groups of interests namely ν(N-H), ν(C=O), ν(C-N) and ν(C=S) at 3155-3422 cm^{-1}, 1645-1683 cm^{-1}, 1241-1384 cm^{-1}, 666-799 cm^{-1}, respectively. In the case of **L13**, the stretching vibration of C=O, C-N and C=S indicate some double band character at about 1683 cm^{-1}, 1384 $cm^{-1}$and 735 cm^{-1}. **Scheme 3** shows the generic structures for all compounds labelled as **(L1-L28)** with their substituent groups.



R_1 = 2-Me, R_2 = H **(L1)**
R_1= 2-Me, R_2 = phenyl **(L2)**
R_1 = 2-Me, R_2= 4-aminobutric acid **(L3)**
R_1 = 2-Me, R_2 = 3,4-dichlorophenyl **(L4)**
R_1 = 2-Me, R_2 = 2,3-dimethylphenyl **(L5)**
R_1 = 2-Me, R_2 = 2,4-dimethylphenyl **(L6)**
R_1 = 2-Me, R_2 = 2,6-diethylphenyl **(L7)**
R_1 = 2-Me, R_2 =2,4-dimethoxyphenyl **(L8)**
R_1 = 2-Me, R_2 = 2,5-dimethoxyphenyl **(L9)**
R_1 = 2-Me, R_2 = 4-ethoxylphenyl **(L10)**
R_1 = 2-Me, R_2 = 2,2-dimethoxyethyl **(L11)**
R_1 = 2-Me, R_2 = 2-amino-3-methylpyridine **(L12)**
R_1 = 2-Me, R_2= 2-amino-6-methylpyridine **(L13)**
R_1 = 2-Me, R_2 = 4-amino-2,2,6,6-tetramethylpyridine **(L14)**
R_1 = 3-Me, R_2= 3,4-dichlorophenyl **(L15)**
R_1 = 3-Me, R_2 = 2,3-dimethylphenyl **(L16)**
R_1 = 3-Me, R_2 = 2,4-dimethylphenyl **(L17)**
R_1 = 3-Me, R_2 = 2,6-diethylphenyl **(L18)**
R_1 = 3-Me, R_2 =2,4-dimethoxyphenyl **(L19)**
R_1 = 3-Me, R_2 = 2,5-dimethoxyphenyl **(L20)**
R_1 = 3-Me, R_2 = 4-ethoxylphenyl **(L21)**
R_1 = 3-Me, R_2= 4-aminobutric acid **(L22)**
R_1 = 4-Me, R_2 = 3,4-dichlorophenyl **(L23)**
R_1 = 4-Me, R_2 = 2,3-dimethylphenyl **(L24)**
R_1 = 4-Me, R_2 = 2,4-dimethylphenyl **(L25)**
R_1 = 4-Me, R_2 = 2,6-diethylphenyl **(L26)**
R_1 = 4-Me, R_2 =2-methoxyethylamine **(L27)**
R_1 = 4-Me, R_2 = 2,5-dimethoxyphenyl **(L28)**

Scheme 3. Numbering scheme of 2, 3 and 4-methylbenzoylthiourea derivatives series

In addition, infrared spectrum of new complex shows the change on frequencies of the carbonyl band, ν(N-H) from 3206 cm^{-1} to 3072 cm^{-1} and ν(C=O) 1666 cm^{-1} to 1586 cm^{-1} which indicating the ligand acts as bidentate chelating agent. The UV-Vis characteristic of **(L1-L28)** were observed at between λ_{max} 201-338 nm that can be assigned as mixture of n→π* and π→π* transitions. As shown in **Table 1**, **D1** complex displays toward blue shift at lower energy between 228 to 277 nm, whereas at about 459 nm, could be

assigned as charge transfer transition between ligand to metal or metal to ligand. However, there is little evidence if any showing the existence of d-d transition in the d^9 system of the complex. This is also may due to the combination with charge transfers (CT) transition of ligand.

Table 1. UV-Vis data for the ligand **L25** and **D1** Cu(II) complex

Compounds No.	Absorption λ / nm (Extinction Coefficient ε / M^{-1} cm^{-1}) / Electronic transitions		
	CT and d-d	π→π*	Mixed n→π*, π→π*
L25	-	201.00 (55700) 236.00 (96000)	236.00 (96000) 280.00 (60037)
D2	459.00 (747)	228.00 (60100)	277.00 (90900)

In the ^{1}H NMR spectra, the signal of δ_H(N1) and δ_H(N2) presence at around δ_H10-13 ppm. Whilst in ^{13}C NMR spectra, the signal for carbonyl and thione atoms were observed at around δc 169-182 ppm and δc 153-174 ppm. The title compounds of **(L1-L2**, **L4-L7**, **L12**, **L14**, **L18** and **L25)** adopt *trans-cis* configuration with respect to the positions of the methylbenzoyl and amine substituent groups relative to the thiono S atom across their C-N bonds, respectively. However, only **L13** does not show any configuration because the deprotonation of the NH and cyclisation takes place. Surprisingly, **L14** forms an ionic molecule which is stabilised by 2-methylbenzoate ions. The molecules are stabilised by intra and inter-molecular hydrogen bonds, whereas no inter-molecular hydrogen formed in the case of **L13**. Interestingly, new complex of **D1** derived from the desulfurization of **L25** has been prepared and assignable in **Figure 1**. The good agreement between calculated and experimental values in CHNS indicates that the compounds are fairly pure. The melting points of all compounds fall range of 154 to 214°C.

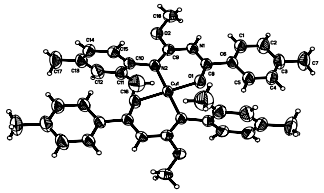


Figure 1. The ORTEP diagram of *bis*-[*N*-(4-methylbenzoyl)-*N'*- (2,4-imethylphenyl) carbamimidate-*κN,O*]copper(II) (D1), showing the atom-labelling scheme. Displacement ellipsoids are drawn at the 50% probability level

The investigation of anticancer screening data revealed that all the tested compounds showed weak to good inhibition. From the observation in HL60 cells, the IC_{50} values for several compounds can be observed at 2.5-28 μg/mL, whereas in MCF-7 cells for **(L4**, **L7-L8**, **L25)** and **D1** complex were found in the range at 14-30 μg/ml, respectively **(Table 2)**. The IC_{50} values for **D1** complex shows moderate potent inhibitory activity against MCF-7 cells growth at 14 μg/ml, whereas **D1** complex does not show 50% inhibition against HL60 cells. This may be due to the square-planar geometry revealed to have more active binding sites in the inhibition of MCF-7 than the HL60 which is less binding to a specific site on the cell. Ali *et al.,* (2006) argue that the lowest IC_{50} values of the complexes owing to an increase in conjugation of the ligand moieties upon complexation.[8] The overall of the preliminary results indicate **L15** and **L17-L19** of 3-methylbenzoylthiourea derivatives ligands exhibit good potential as anticancer agent against HL60 cells within the range IC_{50} values at 2.5-6.0 μg/ml compared with the cytotoxic activity shown by positive control IC_{50} = 1.15 μg/mL.

Table 2. IC_{50} values of the anticancer activity on HL60 and MCF-7 cancer cell lines

Compounds	IC_{50} (μg/ml)	
	HL60	MCF-7
N-2-methylbenzoylthiourea **(L1)**	24	ND
N-(2-methylbenzoyl)-*N'*-(3,4-dichlorophenyl)thiourea **(L4)**	23	30
N-(2-methylbenzoyl)-*N'*-(2,3-dimethylphenyl)thiourea **(L5)**	25.5	ND
N-(2-methylbenzoyl)-*N'*-(2,4-dimethylphenyl)thiourea **(L6)**	14	ND
N-(2-methylbenzoyl)-*N'*-(2,6-diethylphenyl) thiourea **(L7)**	23.5	27
N-(2-methylbenzoyl)-*N'*-(2,4-dimethoxyphenyl)thiourea **(L8)**	25.5	28
N'-(2-methybenzoyl)-*N*'-(3-methyl-2-pyridyl)thiourea **(L12)**	27.5	ND
N-(2-methylbenzoyl)-*N'*-(6-methylpyridine-2-yl)thione **(L13)**	23	ND
N-(2-methybenzoyl)-*N'*-(2,2,6,6-tetramethylpiperidine-4-yl)thiourea.2-methylbenzoate **(L14)**	24.5	ND
N-(3-methylbenzoyl)-*N'*-(3,4-dichlorophenyl)thiourea **(L15)**	2.5	ND
N-(3-methylbenzoyl)-*N'*-(2,3-dimethylphenyl)thiourea **(L16)**	28	28
N-(3-methylbenzoyl)-*N*-'(2,4-dimethylphenyl)thiourea **(L17)**	2.5	ND
N-(3-methylbenzoyl)-*N*'-(2,6-diethylphenyl) thiourea **(L18)**	5.5	ND
N-(3-methylbenzoyl)-*N*'-(2,4-	6.0	ND

dimethoxyphenyl)thiourea **(L19)**		
N-(3-methylbenzoyl)-*N'*-(2,5-dimethoxyphenyl)thiourea **(L20)**	25.5	ND
N-(3-methylbenzoyl)-*N'*-(4-ethoxyphenyl)thiourea **(L21)**	27.5	ND
N-(4-methylbenzoyl)-*N'*-(3,4-dichlorophenyl) thiourea **(L23)**	22.5	ND
N-(4-methylbenzoyl)-*N'*-(2,3-dimethylphenyl)thiourea **(L24)**	26	ND
N-(4-methylbenzoyl)-*N'*-(2,4-dimethylphenyl)thiourea **(L25)**	20	29.5
N-(4-methylbenzoyl)-*N'*-(2,6-diethylphenyl)thiourea **(L26)**	17.5	ND
N-(4-methylbenzoyl)-*N'*-(2,5-dimethoxyphenyl)thiourea **(L28)**	15	ND
Bis-[*N*-(4-methylbenzoyl)-*N'*-(2,4-dimethylphenyl)methyl carbamimidate-*κN,O*]copper(II) **(D1)**	ND	14
Positive control (Hydrogen Peroxide)	1.15	1.68

ND = Not Determined

CONCLUSION

In this work, the novel series of 2, 3 and 4-methylbenzoylthiourea including one new copper(II) complex have been successfully characterised by typical spectroscopic methods and evaluated as potential anticancer agent. Three compounds of 3-methylbenzoylthiourea series **(L15** and **L17-L19)** exhibit strong cytotoxicity against HL60 compared to the 2 and 3-methylbenzoylthiourea derivatives. The complex of **D1** showed strong cytotoxicity against MCF-7 than in HL60 cells. Indeed, this study was performed as a preliminary step and promising properties to act as anticancer in the development of drugs in the pharmaceutical industry. Further *in vivo* studies should be carried out to elucidate a wide range potentials of these compounds.

ACKNOWLEDGMENTS

The authors gratefully acknowledge Ministry of Higher Education Malaysia for FRGS research grant No:59001, Ministry of Science Technology and Innovation (MOSTI), HRD (S&T) National Science Fellowship (NSF) for the postgraduate scholarship, Universiti Malaysia Terengganu and Universiti Kebangsaan Malaysia for providing research facilities.

REFERENCES

[1] A. C. Moro, A. E. Mauro, A.V.G. Netto, S. R. Ananias, M. B. Quilles, I. Z. Carlos, F. R. Pavan, C. Q.F. Leite, M. Hörner, *European J. of Medicinal Chemistry* 44 (2009) 4611-4615.

[2] M. K. Rauf, I. U. Din, A. Badshah, M. Gielen, M. Ebihara, D. de Vos, S. Ahmed, *J. of Inorganic Biochemistry*103 (2009) 1135–1144.

[3] E. Rodríguez-Fernández, E. García, M. R. Hermosa, A. Jiménez-Sánchez, M. Mar Sánchez, E. Monte, J. J. Criado, *J. of Inorganic Biochemistry* 75 (1999) 181-188.

[4] A. Saeed, U. Shaheen, A. Hameed, S. Z. H. Naqvi, *J. of Fluorine Chemistry* 130 (2009) 1028-1034.

[5] D. Chen , F. Peng, Q. C. Cui, K. G. Daniel, S. Orlu, J. Liu Q. P. Dou, *Frontiers in Bioscience* 10 (2005) 2932-2939.

[6] W. Hernandez, E. Spodine, L. Beyer, U. Schröder, R. Richter, J. Ferreira, M. Pavani, *Bioinorganic Chemistry and Applications* 3 (2005) 3-4.

[7] T. Mosmann, *J. of lmmunological Methods,* 65 (1983) 55-63.

[8] H. M. Ali, S. N. A. Halim, P. Subramniam, S. M. Zain, W. J. Basirun, E. Ismail, N. Abdullah, H. L. Teoh, *Malaysian Journal of Science* 25, 2 (2006) 97-106.

Sperm Viability Assessment Of Banana Shrimp, *Penaeus Merguiensis* (De Man, 1888) For Cryopreservation Process

Memon, A.J[1,*], Ikhwanuddin, M.[1], Talpur, A.D.[1], Fariddudin, M.O[2], Safiah, J[1] and Abol-Munafi, A.B[1].

[1]Institute of Tropical Aquaculture, Universiti Malaysia Terengganu, 21030 Kuala Terengganu, Terengganu, Malaysia,

[2]Fisheries Research Institute Kg Pulau Sayak, 08500 Kota Kuala Muda, Kedah, Malaysia

Corresponding Author: *memon.jabbar@gmail.com & Cell phone No: 017959036

ABSTRACT

A study was conducted to assess the sperm viability of banana shrimp, Penaeus merguiensis collected from Kedah water, West Malaysia (5º 39 N; 100º 19 E) Evaluation were done on fresh and specimens maintained at 2°C prior to extraction. Spermatophores counts were determined by sperm suspension using modified eosin–nigrosin staining protocol method. Percentage of Mean sperm viability for the fresh sample at time zero was 93.96 ±3.74. Viability of the sperm considerably decreased after the first 60 minutes (76.4± 5.96%). These were 67.9± 5.13% and 62.5± 5.008% respectively after 1 to 2 hrs time elapsed. At 5 hrs of ice chesting, the viability decreased significantly to less than 60% (P<0.05). Following, mean sperm viability were considerably decreased to 50.7% ± 4.79% and 37± 6.52% respectively after 7and 9th hrs. There was no significant relationship was observed between biomass of the spermatophore to the body weight of the shrimp (P>0.05). Present study also revealed that specimens maintained at 2°C could be utilized for fishery management through artificial insemination process till 7th hour.

Keywords

Banana shrimp, Penaeus merguiensis Sperm Viability, Artificial insemination

INTRODUCTION

Penaeus merguiensis (De Man, 1888), commonly known as 'Banana shrimp' is among the most important penaeid species in Malaysia. This species also inhabits the inshore waters of Indo-West Pacific region from the Persian Gulf to Thailand, Hong Kong, the Philippines, and Indonesia to New Guinea, New Caledonia, and Northern Australia [9]. Due to its commercial value this species was also introduced into aquaculture field in Malaysia but not cultured as widely as *Penaeus monodon* or *Penaeus vannamei* due to its inefficiency in growing to a marketable size in higher stocking density [8]. It is also to be noted that the selective stocking of shrimp species also increased the disease outbreak in aquaculture industry. The ultimate way to decrease the disease prevalence is to have more choices of shrimp species as a stock for aquaculture. Being an indigenous species, it is of advantage to the countries in south East Asia and Asia Pacific region especially for Malaysia where the government is encouraging farmers to produce more of high value aquaculture species such as *F.merguiensis* [8]. Besides this, it will also be an effective choice of shrimp species for aquaculture, may reduce the disease outbreak that is an unsolved problem with *Penaeus monodon* culture and be a good alternative for the competitive market of *Penaeus vannamei*. In a step towards genetic improvement through selective breeding there is a necessary to have family production base. This indeed needs individual male and female mating. At present, obtaining quality brood stock is one of the utmost important. Experience in this respect showed that individual mating is always hard to success [8]. Thus sperm injection seems to be a practical choice. The ability to prolong the sperm activity after being accumulated from good quality male partners is prerequisite to ensure the apparent success. It is evident from the recent research that preservation of spermatophore for long periods would be a greater advantage for future breeding programs [20]. Chilled storage is a useful technique which has been employed to extend the life of extracted spermatophore of freshwater shrimp, *Macrobrachium rosenbergii* [6] and lobster, *Homarus americanus* [12]. Development of a sperm viability assessment technique for spermatophore could provide a more reliable supply of high quality spermatophore, ease short-term spermatophore banking and artificial insemination activities, improve efficiencies in hatchery management, and allow easy transportation of male gametes in specialized breeding programs [10]. The classic method of assessing the viability of sperm is to determine the percentage of progressively motile cells by using a microscope [14]. Different staining combination has been shown to be a rapid and reliable means for determining the proportions of living and dead sperm in several species across taxonomic lines [20,18,1]. Sperm viability and fertilizing capability such as trypan blue stain exclusion [21, 5], eosin—nigrosin stain response [5], sperm-egg attachment [4], biochemical analysis [5], induction of sperm acrosome reaction [3], fertilization assay [4, 5] It was documented that the average sperm viability of fresh *P. monodon* at zero

time was 97.8 % [17]. However, report on sperm viability assessment in *F. merguiensis* is still scanty. The investigation will uncover the change in viable sperm percentage of *P. merguiensis* collected from the fresh and maintained at *2°C* ice chilled samples and their relationship with the body and spermatophore weight of the animal.

MATERIALS AND METHODS

Specimen source and maintenance

Sexually matured males specimens of *P. merguiensis* were collected from Kota Kula Muda, Palau Sayak, Kedah, Malaysia (5º 39□ N; 100º 19□ E) and transported to marine hatchery at the Institute of Tropical Aquaculture, University Malaysia Terengganu (UMT). On arrival, each specimen was treated with 3 ppm potassium permanganate ($KMNO_4$), solution for 10 to 15 minutes to eradicate unwanted microorganisms [16]. The shrimp specimens were transferred to holding tank at a density of three individuals per m^2 in a 5 m^2 rectangular tanks with water depth of 80 cm. Samples were kept in sea water at 30 ppt. The specimens were maintained in hatchery condition under normal local photoperiod cycle of about 12-h light: 12-h dark. Feeding were commenced twice daily, morning and afternoon with mixed fresh squid and mussels at a rate of 30 percent of the biomass. Following, leftover foods were siphoned out and water exchanges were done at about 20 percent.

Spermatophore collection

Specimen was selected with sign of a clear white swelling around the coxae at the base of the fifth walking leg (pereiopods). Only spermatophores that were not melanized were selected for preservation studies [7]. Upon observation, the identified males were then removed and wrapped in a wet cloth. Following, soft pressure was applied with the thumb between the abdomen and the base of the fifth walking leg to eject out the spermatophores. The protruded spermatophores were pulled out with a pair of sterile forceps and each spermatophore was weighed and transferred into glass homogenizer (High speed variable speed reversible, Glas-col, Terre Havte In USA) with 200µl of Ca-F saline.

Spermatophore assessment study

Sperm sample preparation

Sperm viability assessments were done in every hour (within range of zero to 9 hours) after the specimens were sacrificed. The time zero was referred to the collection of sperm immediately after the shrimp was sacrificed. The live specimens were killed and maintained freshness in at 2°C [22]. Spermatophores of three males' specimens were sampled out in every hour. The spermatophore from each study group was then divided equally to produce six replications to produce a final of 18 analyzed samples.

Sperm viability assessment

Sperm viability was determined by a modified eosin–nigrosin staining protocol method [17]. Initially, a known spermatophore specimens were weighted and transferred to a glass homogenizer with 200 µl of Ca-F saline and gently ground to form a sperm suspension. 50µl of sperm suspension was transferred to a clean glass slide and. mixed with 50µl of eosin and nigrosin (dissolving 0.5 g of eosin in 100 ml distilled water and the nigrosin solution was prepared by dissolving 0.10 g of nigrosin also in 100 ml distilled water.) and air-dried prior to microscopic observation.

Viability Spermatophores were subsequently evaluated under an Advanced Research Microscope (EPI-Fluorescence) Japan. Live sperm was unstained against the blue background of nigrosin, whereas dead sperm appeared pink. Percentage of viable sperm was evaluated from a minimum of 300 sperm cells from each slide.

DATA ANALYSIS

Data were analyzed using SPSS 16.0 (SPSS Inc., Chicago, IL, USA). One way ANOVA test was performed to check the significance value ($P < 0.05$). Pearson Correlation (2 tailed) was calculated to determine the influence of sample weight and spermatophore weight over the percentage of viable sperm count at different times. (e.g.,Table: 2). Percentage of viable sperm were calculated by following formula

$$\text{Percentage of live sperm} = \frac{\text{Observed number of live sperm}}{\text{Total Number of sperms observed}} \times 100$$

RESULTS

Mean sperm viability of the fresh samples was 93.96 ± 3.74 % (N= 18) at initial time (time zero). Viability of the sperm considerably decreases in the first 60 minutes (76.4± 5.96%). There was no much fluctuation in the viability of sperm observed when the time elapses next 120 minutes. At 5 hrs of specimens maintained at 2°C, the viability of sperm was decreased to less than 60% showing that the exposure of viable sperm to the low temperature for more than 5 hrs could mitigate the viability of the sperm considerably. It was also observed that spermatophore retained above 50% of viable sperm till 7 hrs of icechesting Significant decline in the viable sperm count was observed at eight hrs specimens maintained at 2°C with mean percentage of viable sperm is 43.6± 5.85 % showing that sperm viability of the specimens maintained at 2°C decreases with elapsing time (Table 1).

Table 1: Variation in the viability of the sperm over the time (every hour) is showing the mean percentage of viable sperms reduce with elapsed time (N=30).

Time (min)	Replication	Mean B/W of shrimp (g)	Mean Wt: of spermatophore (g)	Live sperm (%)
0	18	26.46 ±2.04	0.077 ±0.01	93.94 ±3.74
60	18	26.36 ±0.26	0.0712 ±0.004	76.4 ±5.96
120	18	26.45 ±0.25	0.074 ±0.004	67.9 ±5.13
180	18	26.81 ±1.05	0.074 ±0.074	62.5 ±5.008
240	18	27.29 ±0.75	0.079 ±0.002	59.4 ±4.16
300	18	26.19 ±0.38	0.068 ±0.005	57.7±3.34
360	18	26.53 ±0.56	0.08 ±0.003	56.6 ±2.83
420	18	24.1 ±0.43	0.072 ±0.007	50.7 ±4.79
480	18	25.13 ±0.62	0.068 ±0.008	43.6 ±5.85
540	18	24.97 ±0.43	0.07 ±0.002	37 ±6.5

DISCUSSION

Mean sperm viability of the fresh sample was 93.96 ± 3.74 % at initial time (time zero). This observation might be due to the hatchery holding time or quality of the wild male shrimp used in analyzing the sperm viability of the species. Similar observation was documented by earlier study where the quality of sperm/spermatophores in mature males was often related directly to hatchery holding time [2] , in this study, expected mean sperm viability of 100% could not be observed at initial (time zero). On the other hand, average sperm viability of 97.8 % was documented in fresh *P. monodon* at zero time [13], and prefreezes evaluation of spermatophore viability were more than 98% in *Scylla serrata* Crab [23].

Viability of the sperm considerably decreased in the first 60 minutes (76.4± 5.96%). This might be due to the sudden ice shock (at 2°C), could trigger the considerable level of sperm death which ultimately influenced the viability of the sperm. Similar observation was reported by [19] where highest sperm survival of 56% was observed when sperms of marine Shrimp *Sicyonia ingentis* were kept at lºC. There was no much fluctuation in the viability of sperm observed when the time elapsed next 120 minutes. This might be due to the tolerable capacity for sperms to withstand the gradually decreasing/maintaining temperature to the considerable amount of time. At 5 hrs of exposure to ice the viability of sperm decreased to less than 60% showed that the exposure of viable sperm to the low temperature for more than 5 hrs could mitigate the viability of the sperm considerably. Significant decline in the viable sperm count was observed at 8 hrs of specimens maintained at 2°C (43.6± 5.85 %) showed that sperm viability of the specimens maintained at 2°C decreases with elapsing time. Similar observation was reported in *P.monodon* when the viable sperms were stored for longer duration in liquid nitrogen (>60 days) significantly decreased sperm viability ($P < 0.05$) [17]. There was no signmificancy ($P>0.05$) observed between the weight of the spermatophore and the body weight of the organism. Similarly there was no relationship observed among the weights of the sample, spermatophore weight with their corresponding viable sperm count (Table 2).

CONCLUSION

Present observation proved that elapsing time has significant influence on the percentage of viable sperm count. The specimens maintained at 2°C spermatophore sample undergo sudden low temperature shock which ultimately reduces the percentage of live sperm count but retains the considerable amount of viable sperm (>50%) until 7th hour specimens maintained at 2°C These observations provide apparent proof that the specimens maintained at 2°C spermatophore sample from the quality male could be used for fishery management through artificial insemination process till 7th hour.

ACKNOWLEDGEMENT

This research was supported by a grant from the MOSTI (science fund) under Project No. 05-01-12-SF1004. Authors wish to extend their sincere gratitude to Directorate of fisheries inland Hyderabad Government of Sindh, Pakistan and Fishries Research Institute Kg Pulau Sayak for their constant support and technical assistance throughout this study. Authors also wish to extend their thanks to University Malaysia Terengganu (UMT) for providing infrastructure facilities

REFERENCE

[1] Adams, S.L., Hessian, P.A., and Mladenov, P.V., 2003, Flow cytometric evaluation of mitochondrial function and membrane integrity of marine invertebrate sperm: Invertebrate Reproduction and Development, v. 44, p. 45-51.

[2] Aiken D,Waddy S. Reproductive biology. In: Cobb S, Phillips B,editors. The biology and management of the American Lobster,vol. 1. New York: Academic Press; 1980. p. 215–76.

[3] Anchordoguy T.J., Crowe J.H., Griffin F.J. & Clark W.H. Jr (1988) Cryopreservation of sperm from the marine shrimp Sicyonia ingentis. Cryobiology 25, 238—243.

[4] Behlmer S.D. & Brown G. (1984) Viability of cryopreserved spermatozoa of the horseshoe crab, Limulus polyphermus L. International Journal of Invertebrate Reproduction and Development 7, 193—199.

[5] Bhavanishankar S.&SubramoniamT.(1997) Cryopreservation of spermatozoa of the edible mud crab Scylla serrata (Forskal). Journal of Experimental Zoology 277, 326—336.

[6] Chow, S., 1982. Artificial insemination using preserved spermatophores in the palaemonid shrimp Macrobrachium rosenbergii. Bulletin of the Japanese Society of Scientific Fisheries 48, 1693–1695.

[7] Dougherty WJ, Dougherty MM. Ultra structure observations on melanized sperm in developing and fully formed Spermatophores of male

shrimp, Penaeus vannamei. In: Perkins FO, Cheng TC, editors. Pathology in marine science. New York: Academic Press; 1990. p. 387–94.

[8] Fariduddin Othman Senior Research Officer Department Of Fisheries Malaysia, Country Report (Recent report on Coastal/Marine Aquaculture status in Malaysia March 2006)

[9] Grey, D. L., Dall, W., Baker, A. (1983). A guide to the Australian penaeid prawns. Department of Primary Productlon,Northern Territory, Australia

[10] Grout B.W.W., Morris G.J. & McLellan M.R. (1992) Cryopreservation of gametes and embryos of aquatic organisms. Symposium of the Zoological Society of London 64, 63—71.

[11] Gwo J.-C. (1995) Cryopreservation of oyster (Crassostrea gigas) embryo. Theriogenology 43, 1163—1174.

[12] Humana Press, Totowa, NJ. McNiven, M.A., Gallant, R.K., and Richardson, G.F., 1992, In vitro methods of assessing the viability of rainbow trout spermatozoa: Theriogenology, v. 38, p. 679-686

[13] Ishida, T., Talbot, P., Kooda-Cisco, M., 1986. Technique for the longterm storage of lobster (Homarus) spermatophores. Gamete Research 14, 183–195.

[14] Jenkins, J.A., 2000, Infectious disease and quality assurance considerations for the transfer of cryopreserved fish gametes, *in* Tiersch, T.R, and Mazik, P.M., eds., Cryopreservation in Aquatic Species: Baton Rouge, La., World Aquaculture Society, p. 343-363.

[15] Motoh, H.1981 Studies on the Fisheries Biology of the giant tiger prawn Penaeus monodon in the Philippines. SEAFDEC Technical Report No. 7 127 pps.

[16] Nimrat S, Sangnawakij T, Vuthiphandchai V. Preservation of Black Tiger Shrimp (Penaeus monodon) Spermatophores by Chilled Storage. J World Aquacult Soc 2005; 36:76–86.

[17] Segovia, M., Jenkins, J.A., Paniagua-Chavez, C., and Tiersch. T.R., 2000, Flow cytometric evaluation of antibiotic effects on viability and mitochondrial function of stored sperm of Nile tilapia: *Theriogenology* v. 53, p. 1489-1499.

[18] Thomas, A.,John,H.C.,Crowe.C.,Fred.JG andWallish.C.JR 1988.Cryopreservation of Sperm from the Marine Shrimp *Sicyonia ingentis* Cryobiology 25, 238-243

[19] Thomas, C.A., Garner, D.L., DeJarnette, J.M., and Marshall, C.E., 1998, Effect of cryopreservation on bovine sperm organelle function and viability as determined by flow cytometry: Biology of Reproduction, v. 58, p. 786-793.

[20] Wang Q.Y., Misamore M., Jiang C.Q. & Browdy C.L. (1995) Egg water induced reaction and biostain assay of sperm from marine shrimp Penaeus vannamei: dietary effects on sperm quality. Journal of the World Aquaculture Society 26, 261—271.

[21] Geraci, J.R. 1978. Nutrition and nutritional disorders. *In* M.E. Fowler., ed., Zoo and Wild Animal Medicine, pp. 568. W.B. Saunders, Philadelphia.

[22] Jeyalectumie C, Subramoniam T. Cryopreservation of spermatophores and seminal plasma of the edible crab Scylla serrata. Biol Bull 1989; 177:247–53.

Cytotoxicity and Genotoxicity Study of Novel Amino Acid-Thiourea Derivatives on *Acanthamoeba castellanii*

Maizatul Akma Ibrahim[1]*, Nakisah Mat Amin[1] M. Sukeri M. Yusof[2]
[1]Department of Biological Science, [2] Department of Chemical Science, Faculty of Science and Technology, Universiti Malaysia Terengganu, 21030 Kuala Terengganu, Terengganu, Malaysia.
*maironan@yahoo.com[1], nakisah@umt.edu.my

ABSTRACT
Previous studies proved that thiourea derivatives have the properties of antibacteria, antifungus, anticancer and anti-HIV. Therefore, six novel amino acid-thiourea derivatives which had been successfully synthesized and characterized by chemistry research group of UMT were investigated for their cytotoxicity and genotoxicity effects on Acanthamoeba castellanii strain 1501/2A (CCAP, UK). Inhibition concentration of 50% amoeba population (IC_{50}) after the treatment with the compounds was examined as an evidence of these compounds cytotoxicity. Their membrane integrity was investigated on the treated amoeba cells. The DNA laddering and alkaline comet assays were also being carried out to study the mode of cell death and extent of DNA damages after the treatment, respectively. Results showed that these derivatives are active against A. castellanii with the IC_{50} values in the range between 2.0 to 3.5µg/mL. By acridine orange and propidium iodide (AO/PI) staining, Acanthamoeba were observed to have lost their membrane integrity. The DNA laddering assay result indicated that the amoeba cells undergone apoptosis after the treatment. Meanwhile, the investigation by the alkaline comet assay showed that these compounds cause damages on DNA at the score 2 and 3.

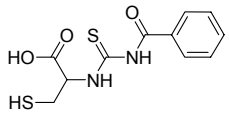
Keywords
Acanthamoeba, thiourea, cytotoxicity, membrane permeability, apoptosis, comet assay.

INTRODUCTION
Thiourea, CSN_2H_4 is an organic compound which has three functional groups that are important for the structural modifications in order to synthesize new derivatives. Thiourea and its derivatives display a broad spectrum of applications in chemistry, industries, medicines and others. Recently, a lot of thiourea derivatives have been synthesized and their antimicrobial properties were widely explored [1-5]. It is well known that a number of heterocyclic compounds containing nitrogen and sulfur as observed in thiourea derivatives exhibited a wide variety of biological activity [3]. Previous researches revealed the potentials of thiourea derivatives as antioxidant [6], anti-HIV and antituberculosis agent [7]. Therefore in this study, six novel amino acid-thiourea derivatives which had been successfully synthesized and characterized by Dr Mohd Sukeri's research group were used to examine their antiamoebic activities against *Acanthamoeba* cells.

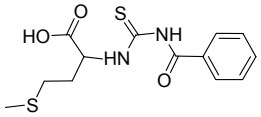
Acanthamoeba are the free-living protozoan that ubiquitously distributed in water and soil and feed primarily on bacteria. *Acanthamoeba* was first proposed as a pathogen by Culbertson and co-workers [8], who isolated an amoeba that occurred as a contaminant of monkey kidney cell cultures used in the production of polio virus for vaccine preparation. *Acanthamoeba* can become opportunist when in contact with human hosts and cause two distinct diseases which are granulomatous amoebic encephalitis that affects the central nervous system, and amoebic keratitis which affects the eyes cornea. In this study, *Acanthamoeba castellanii* strain 1501/2A (CCAP, UK) was used for the experiments. The study conducted embarking the cytotoxicity tests of the compounds toward *A. castellanii* which included tests for the viability of cells, membrane integrity, mode of cell death, and the extent of DNA damage.

MATERIALS AND METHODS

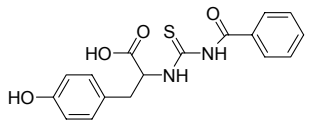
Antiamoebic Activities of Amino acid-Thiourea Derivatives
Six newly synthesized amino acid-thiourea derivative compounds were evaluated for their antiamoebic activities against *Acanthamoeba castellanii* strain 1501/2A (CCAP, UK). These thiourea derivatives with their molecular structures are shown in Figure 1. The codes for the compounds are described in the Table 1.



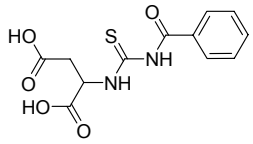
2-(3-benzoylthioureido)-3-mercaptopropanoic acid



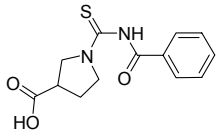
2-(3-benzoylthioureido)-4-(methylthio)butanoic acid



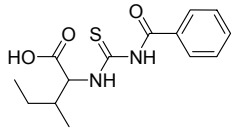
2-(3-benzoylthioureido)-3-(4-hydroxyphenyl)propanoic acid



2-(3-benzoylthioureido)succinic acid



1-(benzoylcarbamothioyl)pyrrolidine-3-carboxylic acid



2-(3-benzoylthioureido)-3-methylpentanoic acid

Figure 1. Six amino acid-thiourea derivatives

Table 1. Amino acid-thiourea derivatives coding

Compounds	Code
2-(3-benzoylthioureido)-3-mercaptopropanoic acid	cys-tu
2-(3-benzoylthioureido)-4-(methylthio) butanoic acid	met-tu
2-(3-benzoylthioureido)-3-(4-hydroxyphenyl) propanoic acid	tyr-tu
2-(3-benzoylthioureido) succinic acid	asp-tu
1-(benzoylcarbamothioyl)pyrrolodine-3-carboxyl acid	pro-tu
2-(3-benzoylthioureido)-3-methylpentanoic acid	ile-tu

Cytotoxicity of Antiamoebic Activities of Amino acid-Thiourea Derivatives

Determination of IC_{50} for Thiourea Derivatives

The test was conducted in 96–well plates (BD Falcon, USA) containing 10^4 cells/well amoeba suspensions and polypeptone medium with the derivative compounds at the concentrations of 25, 12.5, 6.25, 3.13, 1.56, and 0.78µg/mL from the two-fold dilution in 0.25% dimethyl sulfoxide (DMSO) (Sigma, USA). Chlorhexidine digluconate (Sigma, USA) was used as positive control. Three replicates were established for each treatment. The viable cells after the cytotoxicity test were determined by using eosin dye method [9]. The amount of eosin dye released corresponds to the number of viable cells. The absorbance was measured at 490 nm by ELISA plate reader (Tecan A-5082, Australia).

Investigation on the Cells Membrane Permeability

The stains stock were prepared by adding 2 µL acridine orange (AO) (Sigma, USA) and 2 µL propidium iodide (PI) (Sigma, USA) in 996 µL phosphate buffered saline. The treated amoeba suspensions at IC_{50} were incubated for 72 hours at 30°C before they were harvested and centrifuged at 2500 rpm at 4°C for 10 minutes. The pellets were added with 20 µL of 0.2% AO/PI and resuspended. The mixtures were placed onto slides and viewed under fluorescence microscopy (Leica Dmire, Germany) in dark condition. The cells were examined on each slide.

Determination of the Mode of Cell Death

Acanthamoeba cells were treated with the derivatives at the IC_{50} concentration for 72 hours and the DNA were harvested by DNeasy Kit (Qiagen, USA) for electrophoresis. The mode of cell death caused by these compounds was determined by the formation of either 'ladder' which indicates the apoptosis, or 'smear' that is the indicator for the necrosis type. These patterns viewed on the agarose gel after the electrophoresis.

Genotoxicity of Antiamoebic Activities of Amino acid-Thiourea Derivatives

Evaluation on the Extent of DNA Damage

The treated cells at IC_{25} of 3 hours were harvested to get the pellets and transferred onto the fully frosted microscope slides to make the layers of 0.6% normal melting agarose (Promega, USA) and 0.7% and 0.5% low melting agarose (Fisher Scientific, UK). The electrophoresis was conducted in the alkaline pH. This assay was carried out based on Lah et al. [10]. The slides were viewed under the fluoresce microscope (Leica Dmire, Germany). The damages of the DNA appeared in the comet forms with distinct head and tail. The scores (0-4) of the 100 random cells on each slide were recorded.

RESULTS AND DISCUSSIONS

Cytotoxicity of Antiamoebic Activities of Amino acid-Thiourea Derivatives

The determination of IC_{50} for Thiourea Derivatives

The compound concentrations that inhibit 50% *Acanthamoeba* cells population was observed to be in the range between 2.0 and 3.5 µg/mL in concentration. Based on the classification by Deharo et al. [11], these novel derivatives proved to have potent antiamoebic activities against *Acanthamoeba* cells. The compounds labeled as cys-tu and ile-tu have shown to have higher activities toward the species compared to the other four compounds.

Table 2. IC_{50} values of derivatives compounds against *A. castellanii* 1501/2A (CCAP, UK)

Compounds	IC_{50} (µg/mL)
cys-tu	2.0
tyr-tu	2.4
met-tu	3.5
asp-tu	2.2
pro-tu	2.3
ile-tu	2.0

The Investigation of Acanthamoeba Membrane Permeability

By using the AO/PI dyes simultaneously, the membrane permeability of the *Acanthamoeba* cells after the treatment with the thiourea derivatives compounds could be investigated. The healthy or viable amoeba cells with intact plasma would fluoresce green as they only allowed the penetration of permeable dye that was AO. The observation on the treated *Acanthamoeba* demonstrated leakage of membranes resulting from the penetration of the impermeable PI dye, which colored the cells with orange fluorescence. Thus, this experiment shows that these new thiourea derivatives could change the membrane integrity of *Acanthamoeba* cells.

The Investigation of Acanthamoeba Mode of Cell Death

Cells may undergo at least two types of cell death which are necrosis and apoptosis. Necrosis is a violent form of degeneration affecting extensive cell populations, leading to the release of intracellular contents and inflammation. Meanwhile, apoptosis or programmed cell death (PCD) is identified in single cells usually surrounded by healthy-looking neighbors, and characterized by cell shrinkage, blebbing of the plasma membrane, maintenance of organelle integrity, and condensation and fragmentation of DNA [12]. Apoptosis is the main component in development and disease. It occurs naturally as part of the normal development, maintenance, and renewal of tissues within organism [13]. In this study, these thiourea compounds were found to have the ability to induce the apoptosis or PCD as shown by the 'ladder' pattern on the gel electrophoresis (Figure 2).

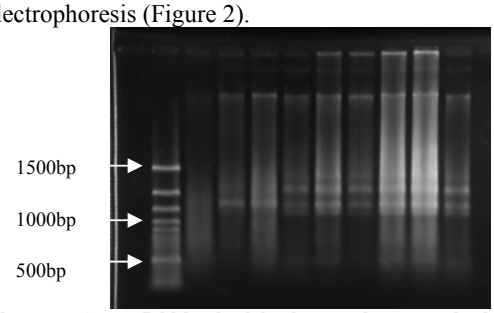


Figure 2. DNA laddering shows 'ladder' pattern on the agarose gel (Lane 1: 100bp marker, Lane 2: Untreated *A. Castellanii*, Lane 3-10: *A. castellanii* treated with amino acid-thiourea derivatives)

Genotoxicity of Antiamoebic Activities of Amino acid-Thiourea Derivatives

Evaluation on the Extent of DNA Damage

The data from the comet scoring were based on the proportions of cells altered migration from classification by Collins [14]. Most of the treated cells were observed to cause damage in the DNA at the score 2 and 3. This result indicates the capability of these thiourea derivatives to cause damage in the DNA of *Acanthamoeba* after a short time of exposure. This criterion is important to ensure that they could be developed as new potential therapeutic agent with genotoxicity ability.

CONCLUSION

A series of novel amino acid-thiourea derivatives which comprised of six novel compounds were synthesized for the antiamoebic property investigations have shown that they have potent antiamoebic activities. From this study, 2-(3-benzoylthioureido)-3-mercaptopropanoic acid and 2-(3-benzoylthioureido)-3-methylpentanoic acid were observed to have better activities compared to the other four derivatives. The study proved that these derivatives induce apoptosis and change the membrane integrity of these unicellular cells. They also have been proved to be potential genotoxicity agents. Future research should envision studies on mechanisms of these amino acid-thiourea derivatives activities on amoeba cells. The structure-activity relationship (SAR) study is also relevant to emphasize the activities exhibited by thiourea compounds due to changes in their molecular structures. Structure modifications could be very useful to enhance the properties of these compounds toward the development of new antiamoebic agents.

ACKNOWLEDGMENTS

My special gratitude to Universiti Malaysia Terengganu, and also Ministry of Science, Technology and Innovation, Malaysia (MOSTI). This research was financially supported by the MOSTI E-Science Fund (52022).

REFERENCES

[1] Chen. S., Wu. G. and Zeng. H. Preparation of high antimicrobial activity thiourea chitosan-Ag^{+} complex. *Carbohydrate Polymers 60 (2005) 33-38.*

[2] Eweis. M., Elkholy. S.S. and Elsabee. M.Z. Antifungal efficacy of chitosan and its thiourea derivatives upon the growth of some sugar-beet pathogens. *International Journal of Biological Micromolecules 38 (2006) 1-8.*

[3] Khan. S.A., Singh. N. and Saleem. K. Synthesis, characterization and in vitro antibacterial activity of thiourea and urea derivatives. *European*

Journal of Medicinal Chemistry 43 (2008) 2272-2277.

[4] Turan-Zitouni., G. Sivaci. D.M., Kaplancikli. Z.A and Ozdemir. A. Synthesis and antimicrobial activity of some pyridinyliminothiazoline derivatives. *Il Farmaco 57 (2002) 569-572.*

[5] Zhong. Z., Xing. R., Liu. Song., Wang. L., Cai. S. and Li. P. Synthesis of acyl thiourea derivatives of chitosan and their antimicrobial activities in vitro. *Carbohydrate Research 343 (2008) 566-570.*

[6] Saturnino. C., D'Auria. M., Paesano. N., Saponiero. D., Cioffi. G., Buonerba. M. and De Martino. G. Antioxidant activity of thioureidic derivatives I. *Il Farmaco 58 (2003) 823-828.*

[7] Küçükgüzel. İ., Tatar. E., Küçükgüzel. S. G., Rollas. S. and De Clercq. E. Synthesis of some novel thiourea derivatives obtained from 5-[(4-aminophenoxy)methyl]-4-alkyl/aryl-2,4-diydro-3H-1,2,4-triazole-3-thiones and evaluation as antiviral/anti-HIV anti-tuberculosis agents. *European Journal of Medicinal Chemistry 43 (2008) 381-392.*

[8] Culbertson, C.G., J.W. Smith and J.R. Minner. *Acanthamoeba*: *Observations on Animal Pathogenicity (1958)127:1506.*

[9] Wright. C. W., O'Neill M. J., Phillipson J. D., and Warhust. D. C. Use of microdilution to assess in vitro antiamoebic activities of *Brucea javanica* fruits, *Simarouba amara* stem, and a number of Quassinoids. *Antimicrobial Agents and Chemotherapy 32 (1988) 1725-1729.*

[10] Lah, B., Malovrh, S., Narat, M., Cepeljnik, T and Marinsek-Logar, R. 2004. Detection and quantification of genotoxicity in wastewater-treated *Tetrahymena thermophila* using the comet assay. Environmental Toxicology 19. 6:545-53.

[11] Deharo, E., Bourdy, G., Quenevo, C., Munoz, V., Ruiz, G and Sauvain, M. A search for natural bioactive compounds in Bolivia through a multisciencedisplinary approach. Part V. Evaluation of the antimalarial activity of plants used by the Tacana Indians. *Journal of Ethnopharmacology*, 77 (2001) 91-98.

[12] Kerr, J. F. R., Wyllie, A. H. and Curie, A. R. Apoptosis: A Basic Biological Phenomenon with Wide-Ranging Implications in Tissue-Kinetics. *British Journal of Cancer 26 (1972) 239-257.*

[13] Hine R., and Martin E. (2004) Oxford Dictionary of Biology. Great Britain: Oxford University Press.

[14] Collins, A.R. 2004. The comet assay for DNA damage and repair: principles, applications, and limitations. Molecular Biotechnology 26. 3:249-61.

Genetic Mating System of Spotted Seahorse (*Hippocampus kuda*, Bleeker,1852)

Ooi Boon Leong, Juanita Joseph, Choo Chee Kuang, Siti Aishah Abdullah
Department of Marine Science, Faculty of Maritime studies & Marine Science
University Malaysia Terengganu, 21030, Kuala Terengganu, Terengganu
oceanooi@hotmail.com, Juanita@umt.edu.my

Absract
This study present the first data collected on the genetic mating system of the spotted seahorse (*Hippocampus kuda*) in Malaysia. We examined maternity within 19 egg broods from 19 individual males from Pulai Estuary, Johor. A total of 330 embryos were analyzed using 4 polymorphic microsatellite markers (Habd3, Habd9, Hcau11, Hcau36). Results demonstrated that all seahorse broods analysed in this study received eggs only from a single female. These results suggested that the *H. kuda* at Pulai Estuary, Johor exhibit the same genetic mating system (monogamous) as observed for other species of seahorses.

Keywords
Spotted seahorse, *Hippocampus kuda*, microsatellite, monogamous, mating system

INTRODUCTION

Seahorse, from the family Syngnathidae, is a unique fish, where the male get pregnant rather than female (Kuiter 2003). Previous studies conducted in the laboratory on the reproduction behavior of temperate seahorse species (Vincent 1994a; Vincent 1994b; Vincent 1995; Masonjones and Lewis 1996; Masojones and Lewis 2000; Masonjones 2001) showed that these seahorses mated monogamously (single partners). Few studies however were carried out in the tropics (e.g. *Hippocampus comes* by Perante *et al.* 2002) and also showed monogamous mating.

Currently, *Hippocampus kuda* is listed as vulnerable in IUCN red list of threatened species. This species facing at least 30% of declination, mainly cause by harvesting and habitat degradation. Besides, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) added seahorse to Appendix II of the convention, to regulate and to ensure harvesting of seahorse (mainly for traditional Chinese medicine [TCM] and curious) will not cause detrimental effect on the survival of wild population (Project seahorse 2003).
This study was conducted at Pulai Estuary, Johor, one of the largest intertidal seagrass bed in peninsular Malaysia, and it is the major habitat for the spotted seahorse. Pulai Estuary currently facing major coastal development, mainly come the port development. Threats include the total habitat destruction due to the dredging to deepen and channels, effluent runoff from the coal power plant and also toxicant runoff from the proposed petrochemical hub. Due to these concerns, the seahorse population and its mating behavior have to be studied before any drafting of mitigation can be plot out. On the other hand, by understanding the reproduction biology of *H. kuda*, it would give some baseline data for scientist to do habitat conservation, or restoration after the habitat destruction.

Conventionally, females often allocate more energy in reproduction and generally provide parental care (Clutton-Brock 1991). These phenomena normally demonstrated amongst mammals. As for Syngnathid species, males are the one that brood, protect and nourish the young and by doing so, it will significantly increase the survival of the young. This unique mating system will provide an unusual opportunity to explore the relative role of both sex in determine the reproductive success of these species (Vincent and Giles 2003). Males of syngnathid have the most complex brooding structure (brood pouch) and they provide high level of parental care (Vincent 1994*a*). Mating behavior showed that syngnathid fishes have complicated courtship behavior; social monogamy (one partner), social polygamy (multiple partners), conventional sex role (males compete for mate) and sex role reversal (female compete for mate). Field studies shows that seahorses' exhibit strictly monogamous and conventional sex role during courtship (Foster and Vincent 2004), but pipefishes mated polygamously (Jones and Avise 1997). Different embryonic development was observed in previous sampling, it may suggests that spotted seahorse may mate polygamously. Due to that observation, it is important for to investigate whether the male spotted seahorse receive eggs from two or more females. On the other hand, mating system of *Hippocampus kuda* have not been studied so far. Thus, the main objective of this study is to determine the genetic mating system of spotted seahorse.

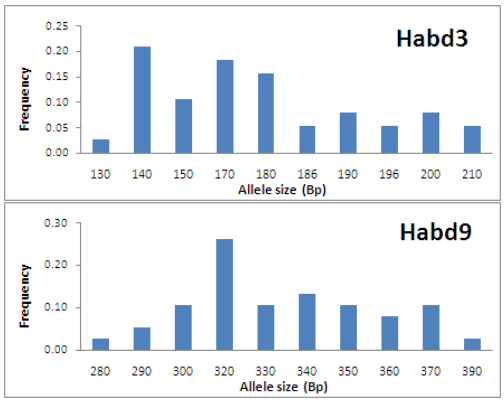
METHODOLOGY

Samples were collected from Pulai Estuary, Johor in 2008 and 2009. Seahorses were captured by hand at low spring and neap tides. The brood samples (about 30 embryos per pregnant male) were siphoned out using capillary tube and preserved in 95% absolute ethanol. Seahorses were tagged using Visual Implant Fluorescence Elastomer (VIFE) (Morgan and Bull, 2005) and released back to the very same spot where they were found. Fin clips of pregnant seahorses were also sampled as references to paternal genotype (Lourie *et al.* 2005).

Whole embryos and adult fin clips were extracted using CTAB protocol (Bruford *et al.* 1992). All DNA's were amplified using seahorse microsatellite loci - *Habd3* and *Habd9* previously developed for *H. abdominalis (*Wilson and Smith 2007), and *Hcau11* and *Hcau36* previously developed for *H. capensis* (Galbusera *et al*. 2007). Polymerase Chain Reaction (PCR) was performed in Bio-Raid DNA engine machines. 10 µl reaction consisted of 1 x Promega *Taq* buffer, 3.5-4.5 mM $MgCl_2$, 0.2 µm of each primer, 0.125 mM of each dNTP's mix, and 0.02 units Promega *Taq* polymerase. The thermal cycling proceeded by 5 min at pre-denaturing at 94°C, 30 seconds of 94°C denaturing, an optimal annealing temperature for 35 seconds and 72°C of extension for 35 second. 35 cycles was employed followed by final extension for 3 minutes at 72°C. Amplified products were screened using 12% 3:1 Acrylamide:Bis-Acrylamide mini-page gel with ethidium bromide dye. To re-confirmed the results, some amplified products were sent off to First Base Sequencing company for fragment analyses using an automated sequencer. Maternity data was analyzed using three different approaches. GENEPOP was used to compute the exact test for Hardy-Weinberg equilibrium, and genotypic linkage disequilibrium among pairs of loci (Raymond and Rousset 1995); Multi-locus approach (DeWoody *et al.* 2000) was used to reconstruct the maternal genotypes to identify the mother to the offspring, and re-confirmed using GERUD (Jones 2001).

RESULTS

All four cross-amplified microsatellite loci were highly polymorphic, with alleles ranging from 8 to 10 (Figure 1), with overall expected heterozygosity of 0.87. All loci were within Hardy-Weinberg equilibrium *(P>* 0.05). Genotypic linkage disequilibrium was not detected for any pair of loci (*P*>0.05), except for Habd3 and Hcau11 (*P* = 0.01). The paternity exclusion probabilities of each locus with one parent known with certainty and one unknown varied between 0.64 and 0.73. When all loci combined the exclusion probability was 0.99 for all samples (Table 1).



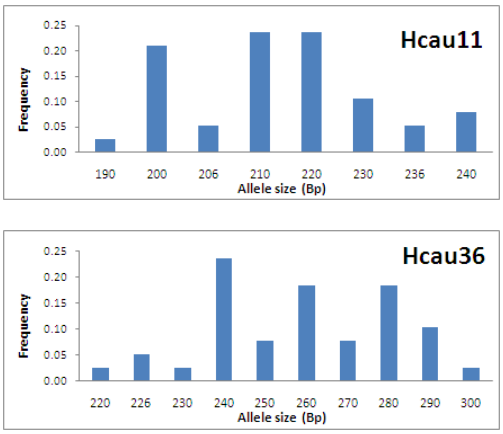


Figure 1: Allele frequency histogram for 4 microsatellite loci in *Hippocampus kuda.* Allelic designations represent size in base pair (bp) of the amplified product.

In total, 19 broods were successfully extracted and amplified. Because the paternal genotypes were tested directly, the paternal alleles of each hatchling could be unambiguously determined. Maternal alleles were reconstructed using multi-locus approach (DeWoody *et al.* 2000) to assess the number of mother in the brood. Confirmation and to accurately reconstruct maternal genotypes, paternal and offspring genotypes were analyzed using GERUD 2.0 (Jones 2001). In the entire sample tested, GERUD produced only one unique solution of maternal genotypic reconstruction. Both the multi-locus approach and GERUD produce the same results. Hence, there is no chance that multiple maternity was not detected in this study.

Table 1: Summary statistic for 4 polymorphic microsatellite loci for spotted seahorse. Shown are locus, alleles observed (n=19), expected heterozygosity and exclusion probabilities.

Locus	Alleles	H_E	Exclusionary power: One parent known with certainty, one unknown
Habd 3	10	0.89	0.73
Habd 9	10	0.88	0.72
Hcau 11	8	0.84	0.64
Hcau 36	10	0.87	0.70
Overall	9.5	0.87	0.99

DISCUSSION

Genetic results of *Hippocampus kuda* in this study showed that all broods were contributed by one female. This suggests that the *H. kuda* from Pulai Estuary, Johor, exhibit the same genetic mating system (monogamous) as observed for other species of seahorses. The results is consistent with previous behavioral observation of social monogamy in other seahorse species (*Hippocampus fuscus (*Vincent 1994*b*); *Hippocampus angustus* (Jones *et al.* 1998); *Hippocampus comes* (Perante *et al.* 2002);

Hippocampus subelongatus (Kvanemo *et al.* 2000); *Hippocampus abdominalis* (Wilson and Smith 2007).

Evolution of the brood pouch system of seahorse has contributed towards the monogamous mating system in seahorses. Because seahorse have enclosed brood pouch, and fertilization occurs internally in the brood pouch (Ah-King *et al.*2006); it may only receive one clutch of eggs per brooding time. Although difference embryonic development was observed in previous sampling, but studies shows that those eggs are come from the same mother, as confirmed by microsatellite analysis. The differential development in the embryos may due to its different speed of development or and also may cause by unhealthy eggs that provided by the female that stunted the development of the embryos.

In terms of evolution, one's reproduction strategy will have to sustained by natural selection, although monogamy is a tedious way of reproduction, but the long-term pair bond must have overweight the cost of reproduction in seahorse. The advantages and disadvantages of monogamous mating system will be discussed.

The most significant advantages are this type of mating system seems to be occur in a low densities habitat, reduced mobility organism and have a fix home range (Parente *et al.* 2002), as seahorse does. By having monogamous mating, it will significantly reduce the effort of seahorse once they find a similar reproductive capacity mate (Jones *et al.* 2003). By mating with the same mate over and over again, interbrood interval will shorten after few generations produced, and seahorse can continuously focus on reproduction without needing extra times to find new mate for the next brooding period (Kvarnemo *et al.* 2000). By knowing the mate capacity and time of brooding, female seahorse can synchronize the hydration of eggs, and by doing that, both partners can directly mate after releasing the matured embryos, thus increase the reproduction rate of seahorse (Vincent 1994*a*). Study shows that when a pair is formed, the pair's capacity to produce offspring was increase with time elapsed since the pair was from (Vincent 1994*b*)

Strict monogamy in seahorse (sexual fidelity) also has their disadvantages. In order to maintain the bonds, the seahorse will have to depend on morning greeting that performed by the partners (Vincent 1995), thus, limit the chances for the seahorse to find for better mate and increase predation rate. By mating with the same partners over and over again, it wills significant effect on the genetic pool of that population, and it will increase the risk of inbreeding due to its low densities and low dispersal rate. Besides, if either party was predated, the whole breeding sequence of that pair will be hampered. Due to the low population density, the partner will have to pay tremendous amount of energy to find a new suitable mate, and thus, increase the predation risk and significantly reduce the reproduction rate of the species. Lastly, seahorses are near shore species that exhibit lower dispersal than pelagic species with broadcast spawning. Seahorses are likely to be the lower end of the marine fish dispersal, means that they have a low mobility offspring that can't disperse well in the water column (Parente *et al.* 2002). Low dispersal and monogamous mating system will significantly impair the recovery of seahorse in Pulai estuaries if the habitat destruction continue in a fast pace. It will force the spotted seahorse into genetic bottle neck or worse, local extinction. Thus, at Pulai estuaries, habitat conservation is more important than restoration after destruction. And by having this baseline date, it can help to create a most detailed spatial scale of the coastal management to protect the species (Lourie *et al*. 2004)

CONCLUSION

In conclusion, this genetic study shows that the spotted seahorse, *Hippocampus kuda* mate monogamously. This finding is consistent with others behavioral studies on related seahorse species that have been proven to have social monogamy mating system. Due to that, protecting the current local population is far more important than the mitigation measures after local extinction of the seahorse, and most detailed spatial scale of coastal management should be designated (Lourie *et al.* 2004) to protect the seahorse before it is too late.

ACKNOWLEDGEMENTS

This study was funded by the Fundamental Research Grants Scheme (FRGS 59023). Sincere thanks to our S.O.S volunteers for helping out with the sampling activities, and the Faculty of Maritime Studies and Marine Sciences of Universiti Malaysia Terengganu for logistical support.

REFERENCES

[1] Ah-King, M., Elofsson, H., Kvarnemo, C., Rosenqvist, G., Berglud, A.,(2006) Where is there no sperm competition in a pipefish with externally brooding males? Insight from sperm activation and morphology. Journal of Fish Biology 68, 958-962

[2] Bruford, M.W., Hanotte, O, Brookfield, J.F.K and Burke, T. (1992) Single-locus and multi-locus finger printing. Pp225-269 in Hoelzel, A.L. (ed.) Molecular genetic analysis of population – A practical approach. Oxford University Press, NY.

[3] Clutton-Brock, T.H. (1988). Reproductive Success. Studies of Individual Variation in Contrasting Breeding Systems. Chicago, IL: The University of Chicago Press

[4] DeWoody, J.A., Walker, D., & Avise, J.C. (2000) Genetic parentage in large half-sib clutches: theoretical estimates and empirical appraisals. Genetics 154:1907-1912.Foster, S.J.

& Vincent, C.J. (2004) Review paper: Life history and ecology of seahorse: implications for conservation and management. Journal of fish biology. 65, 1-61

[5] Foster, S.J., Vincent, A.C.J. (2004) Life history and ecology of seahorses: implications for conservation and management. *Journal of Fish Biology*, 65, 1–61.

[6] Galbusera, P.H.A.., Gillemot, S., Jouk, P., Teske, P.R., Hellemans, B. & Volckaert, F.A.M.J. (2007) Isolation of microsatellite markers for the endangered Knysna seahorse *Hippocampus capensis* and their use in the detection of a genetic bottleneck, Molecular Ecology Notes

[7] Jones, A.G., Avise, J.C. (1997) Microsatellite analysis of maternity and the mating system in the Gulf pipefish *Syngnathus scovelli*, a species Kuiter, Rudie H. (2003). Seahorses, pipefishes and their relative, a comprehensive guide to Syngnathiformes. pp.2. TMC publishing, Chorleywood, UK.

[8] Jones, A.G., Kvarnemo, C., Moore, G.I., Simmons, L.W. & Avise, J.C. (1998) Microsatellite evidence for monogamy and sex-biased recombination in the western Australian seahorse, *H. angustus*. Molecular Ecology. 7, 1497 – 1505

[9] Jones, A. G. (2001) GERUD 1.0: a computer program for the reconstruction of parental genotypes from progeny arrays using multi-locus DNA data. *Mol. Ecol. Notes* **1**, 33.

[10] Kuiter, Rudie H. (2003). Seahorses, pipefishes and their relative, a comprehensive guide to Syngnathiformes. pp.2. TMC publishing, Chorleywood, UK.

[11] Kvanemo, C., Moore, G.I., Jones, A.G., Nelson, W.S. & Avise, J.C. (2000) Monogamous pair bonds and mate switching in the Western Australian seahorse, *Hippocampus subelongatus*. J.Evol. Biol. 13 882-888.

[12] Lourie, S.A., Vincent, A.C.J. (2004) A marine fish follows Wallace's Line: the phylogeography of the three-spot seahorse (*Hippocampus trimaculatus,* Syngnathidae, Teleostei) in Southeast Asia. *Journal of biogeography* (*J.Biogrogr.*) 31, 1975-1985

[13] Lourie, S.A., M. Green and A.C.J. Vincent. (2005). Dispersal, habitat differences, and comparative phylogeography of Southeast Asian seahorses (Syngnathidae: *Hippocampus*). *Molecular Ecology*. 14:1073-1094.

[14] Morgan, S. & Bull, C. (2005). Potential Techniques for Tagging and MarkingSeahorses. Project Seahorse Technical Report No.7, Version 1.0. Project Seahorse,Fisheries Centre, University of British Columbia. 27 pp.

[15] Masonjones, H. & Lewis, S. M. (1996). Courtship behaviour in the dwarf seahorse. *Hippocampus zosterae. Copeia* 1996, 634–640

[16] Masonjones, H. & Lewis, S. M. (2000). Differences in potential reproductive rates of male and female seahorses relative to courtship roles. Animal Behaviour 59, 11–20.

[17] Masonjones, H. D. (2001). The effect of social context and reproductive status on the metabolic rates of dwarf seahorses (*Hippocampus zosterae*). *Comparative Biochemistry and Physiology A* 129, 541–555.

[18] Perante, N.C.; Pajaro, M.G.; Meeuwig, J.J. and Vincent, A.C.J.(2002) Biology of a seahorse species, *Hippocampus comes* in the central Philippines. *Journal of Fish Biology* 60, 821–837

[19] Project Seahorse 2003. *Hippocampus kuda*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. <www.iucnredlist.org>.
Downloaded on **13 October 2010**.

[20] Raymond, M. & Rousset, F., (1995) GENEPOP Version 1.2: population genetic software for exact tests and ecumenicism. J.Hered. 86:248-249

[21] Vincent, A. C. J. (1994*a*). Operational sex ratios in seahorses. *Behaviour* 128, 153–167.

[22] Vincent, A. C. J. (1994*b*). Seahorses exhibit conventional sex roles in mating competition, despite male pregnancy. *Behaviour* 128, 135–151.

[23] Vincent, A. C. J. (1995). A role for daily greetings in maintaining seahorse pair bonds. Animal Behaviour 49, 258–260.

[24] Vincent, A.C.J. & Giles, B.G. (2003) Correlates of reproductive success in a wild population of *Hippocampus whitei*. Journal of fish biology, 63, 344-355

[25] Wilson, A.B. & Smith, K.M.M. (2007) Genetic monogamy despite social promiscuity in the pot-bellied seahorse (*Hippocampus abdominalis)*. Molecular Ecology 16, 2345-2352

Profusion Of Potential Pathogen Bacteria In The Gut Of Blue Swimming Crab Portunus Pelagicus (Linneaus 1758)

*Mir A. D. Talpur, Memon, A. Jabbar[2], K. M. Iqbal[3],
Ikhwanuddin .M[1,2]. and Abol Munafi A.B[1].
Institute of Tropical Aquaculture, Universiti Malaysia Terengganu, 21030, Kuala Terengganu, Malaysia.
*Correspondence author's email: mrtalpur@yahoo.com

Abstract
A research was conducted to isolate and characterize pathogenic bacteria assoc-iated with the gut of swimming crab, P. pelagicus collected from strait of Terbau Johor Malaysia. All isolates were identified by 16S rRNA gene sequencing; result divulged that a consortium of pathogen bacterial diversity prevails includes Vibrio. harveyi, V. parhaemolyticus, Pseudoaltero-monas pscicida, Staphylococcus epid-ermidis and Micrococcus leutus in the gut of crab. The occurrence of these pathogens in the swimming crab, P. pelagicus besides consequence in larval rearing is of epidemiological and health significance.
Key words: Portunus pelagicus, gut, 16S rRNA gene sequencing, epidemiological.

INTRODUCTION

Blue swimming crab, *P. pelagicus* is an important source of animal protein and is a favorite recipe in South East Asia and others parts of the world. This crab found in Indo-West Pacific region [35]. *P. pelagicus* is relatively expensive because the flesh of this crab is very tasty and juicy. This crab demand is largely accomplished through capture production small scale aquaculture is exercised on wild caught seeds. The indigenous microflora of fish, particularly the microbial ecology of the digestive tract, has been investigated by many researchers [31], [14], [24]; [28], [3], [29]. This is due to its assumed importance in digestion and disease control [33], [2], [6]. Various bacteria in marine and estuarine environment such as *vibrio spp* are prospective human pathogen [9], [30]. As crabs are close contact with milieu that rich in pathogen bacteria, infection by bacteria can be vast [15]. Several chitinolytic bacteria (gram-ve rod) such as *vibrio spp.* and *Pseudomonas spp:*.are known to be very fatal pathogens in zoal stages of mud crabs [18], potentially pathogen bacteria in gut of swimming crab, *Callinectes* sp. can have serious ecological, public health and epidemiological implica cations [27]. The present study was aimed to share the knowledge to public regarding the significance of bacterial prospective pathogens of human disease transmitted from shell fish as a food or handling the animal, besides to determine the causative pathogens responsible for mass mortality among larvae rearing of this crab either transmitted from mother or milieu.

MATERIAL AND METHODS

Sample collection

Present study was carried out in the marine hatchery and laboratory of Institute of Tropical Aquaculture, Universiti Malaysia Terengganu, Malaysia. Samples were collected from was Tabrau Strait, Johor, Malaysia (1^o 22' N and 103^o 38' E).

Preparation of sample and identification of microflora.

The whole gut was removed under hygiene condition and pulverized with pestle in sterilized mortar vigilantly and mixed in 10ml of sterlised marine water to prepare serial dilutions 10^{-1}, 10^{-2} and 10^{-3} inoculum for the enumeration of bacterial pathogens. The culture mediums employed were among others, Thiosulphate Citrate Bile Salts (TCBS. Difco, USA), MacConkey agar, Nutrient agar (Merck Germany), Marine agar (Merck Germany) GSP agar (Biolab Hungary). All agars were prepared in marine water with 33 ppt. Inoculum was plated by spread method to every agar plate and incubated for 24 hours at 37 ^oC and isolation was carried out by repeated streaking to ensure purity. The 16S ribosomal gene, was amplified using standard PCR protocol with universal primers27F (5'AGAGTTTGATCCTGGC CAG-3') and 1492R (5'-TACGG YTACCTTG TTA CGACTT-3'). The PCR products were then visualised on a 1%.LE agarose gel (Cambrex Bio Science, USA) Fig-1.

RESULT AND DISCUSSION

Total five isolates were identified and characterized through 16S rRNA gene sequencing. Result divulged the presence of variety of pathogenic floral consortium diversity in the gut of *P. pelagicus* (Table1). The BLASTn search algorithm was used to identify overall sequence similarity of all available 16S sequences in the NCBI GenBank. Biochemical and physiological testes of each isolate was carried [26].

V. harveyi found globally in marine environments is a serious pathogen for a wide range of marine animals [8]. *V. harveyi* that cause vibriosis among fish and shellfish, have shown high mortality in cultured shrimp worldwide [19], [1], [20]; [21], [22].*V. parahaemolyticus* was noticed as the causative agent of infection in Iberian toothcarp *Aphanius iberus* and

have reproduced the same gross signs observed in the outbreak after bacterial challenge [34], [10].

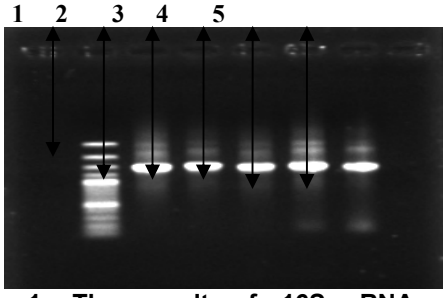


Figure1. The result of 16S rRNA gene sequence PCR amplification product obtained from bacteria DNA. M, GeneRuler indicates 100bp DNA ladder Plus; Lanes 1-5 at 1.5 kb, the species-specific profiles (Samples identified, 1- *Staphylococcus epidermidis* 2- *Vibrio harveyi*, 3- *Vibrio parahaemolyticus*, 4- *Micrococcus luteus,* 5- *Pseudoalteromonas piscicida*).

Vibrio spp. account for a significant number of human infections from the consumption of raw or undercooked seafood, USFDA, 2004, chap. 9 [25]. *V. para-haemolyticus* has emerged worldwide as one of the major causes of gastroenteritis outbreaks associated with shellfish Approximately 7000 human cases of infection with *V. parahaemolyticus*, caused by consumption of contaminated seafood, were reported in southern Chile [12]. M. luteus has been reported as pathogen in aquaculture life caused disease in rain bow trout fry syndrome (RTFS) [5]. Some strains of *M. luteus* can cause septic shock, pnuemonia, and urinary tract infections in an immune-deficient person such as occur with HIV+ patients. *S. epidermidis* has also been reported as pathogen in fisheries science included exophthalamia, congestion and ulceration on tail [17] disease in cultured grass carp in Taiwan [32], in juvenile gillhead [7]. The coagulase-negative *Staphylococci* (CNS) are most common species responsible for human infection [16]. *P. piscicida* has been described as being able to produce a neuromuscular toxin able to kill a variety of fish and crab species [23], [4], [13]. This organism was associated with whitening of eggs, followed by mortalities within 24 hours among eggs of damsel fish, Amphiprion clarkii and Amblygly phidodon curacau [11].

Table 1. 16S rRNA gene sequence analysis results of bacterial strains isolated from gut of *P. pelagicus.*

Accession (Gene Bank)	Species	Max Iden
FJ768459.1	*S. epidermidis* AceN-1	99%
GU262992.1	*V. harveyi* 090212	99%
EU660326.1	*V.parahaemolyticus*	99%
	CM12	
FJ816022.1	*M. luteus* G3-6-08	99%
AB090233.1	*P. piscicida* O-7	99%

Total 12 female crabs were brought under proceedings and no month wise consistency in pathogen from specimen to specimen was observed, Fig-2 and variation in microflra from specimen to specimen in percentage in Fig-3.

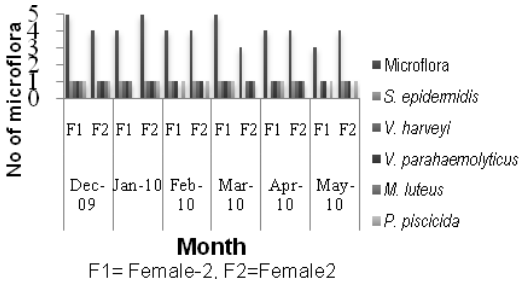


Figure2. Month wise microfloral composition per specimen

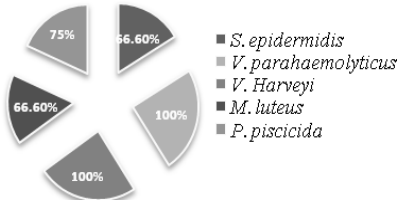


Figure3. % wise microflora in species.

CONCLUSION

Present study showed that *P. pelagicus* crab harbours quite a large variety of life threatening and fatal pathogen for fish and shellfish larvae. Most probably *V. harveyi* bacteria frequently cause heavy loss to new larvae of shellfisheries and fin fisheries. Crab pathogens are liable to transmit to human in different ways such as through food or handling of the animal. Future studies should be focused to determine the stability of the microflora of individual crab gut over time as dependent on feeding, and transfer of flora from mother to eggs, larvae.

ACKNOWLEDGEMENTS

The study project was funded by (Science Fund), Ministry of Science, Technology and Innovation (MOSTI) government of Malaysia under grant Vot. No 52042 and Fisheries Department government of Sindh, Pakistan. The author gratitude to both agencies and extend well wishes. Author is thankful to Universiti Malaysia Terengganu for providing facilities for such study.

REFERENCES

[1] Adams, A.. Response of penaeid shrimp to exposure to Vibrio species. *Fish and Shellfish Immuno:* vol. 1(1991):59–70.

[2] Austin, B. and Al-Zahrani, A.M.J. The effect of antimicrobial compounds on the gastrointestinal microflora of rainbow trout, *Salmo gairdneri* Richardson. *J. Fish Biology* vol.33, (1988) 1–14.

[3] Austin, B., Stuckey, L.F., Robertson, P.A.W., Effendi, I. and Griffith, D.R.W. A probiotic strain of *Vibrio alginolyticus* effective in reducing diseases caused by *Aeromonassalmonicida, Vibrio anguillarum* and *Vibrio ordalii*. *J. Fish Diseases* vol.18, (1995). 93–96.

[4] Bein, S. J A study of certain chromogenic bacteria isolated from "Red Tide" water with description of a new species. *Bulletin Marine Sci. Gulf Caribbean* vol.***4***, (1954). 110-119.

[5] B. Austin, M. Stobie Recovery of *Micrococcus luteus* and presumptive *Planoc-occus* sp. from moribund fish during an outbreak of rainbow trout, *Oncorhy-nchusmykiss* (Walb-aum), fry syndrome in England. *J. Fish Diseases* vol. 15, (1992). 203–206.

[6] Bly, J.E., Quiniou, S.M.A., Lawson, L.A. and Clem, L.W. Inhibition of Saprolegnia pathogenic for fish by *Pseudomonas fluorescens*. *J. Fish Diseases* vol. 20, (1997) 35–40.

[7] Brian Austun, Dawn A. Austun Bacteria Fish Pathogen; Disease of Farmed and Wild Fish. (1999), P -23 (http://books.google.com).

[8] B. Austin and X-H. Zhang *Vib rio harveyi:* a significant pathogen of marine vertebrates and invertebrates. *Letters in Appl. Micro.* vol. 43, (2006). 119–124.

[9] Broza, Y,Y,Y, Danin Poleg, L. Lerner, M, broza and Y. Kashi, *Vibrio vulnificus* typing based on single sequencerepeats. Insight into the biotype 3 group. *J. oclinical. Micro*: vol. 45, (2007) 4995-4999.

[10] Elena Alcaide, Carmen Amaro, Rafael Todoli, Rafael Oltra. Isolation and characterization of *Vibrio parahaemolyticus* causing infection in Iberian toothcarp *Aphanius iberus. (Note), Disease of Aquatic Organisms Vol.* 35, (1999). 77-80.

[11] E. J. Nelson, W. C. Ghiorse. Isolation and identification of *Pseudoalteromonas piscicida* strain Cura-d associated with diseased damselfish (Poma-centridae) eggs. J. *Fish Diseases 22,* (1999) 253–260**.**

[12] Fuenzalida, L., Hernandez, C., Toro, J., Rioseco, M.L., Romero, J., Espejo, R.T., *Vibrio parahaemolyticus* in shellfish and clinical samples during two large epidemics of diarrhoea in southern Chile. *Env. Micro.* vol. 8, (2006). 675–683.

[13] Hansen, A. J.; Weeks, O. B.; Colwell, R. R. Taxonomy of *Pseudomonas piscicida* (Bein) Buck, Meyers and Leifson. *J. Bacteriology* vol. 89, (1965) 752-761.

[14] Horsley, R.W. A review of the bacterial flora of teleosts and elasmobranchs, including methods for its analysis. *J. Fish Biology vol.* 10, (1977) 529–553.

[15] Hudson, D.A. and R.J.G. Lester, Parasite and symbionts of wild mud crabs, Scylla serreta of potential significance in aquaculture. *Aquaculture vol.* 120, (1994). 183-199.

[16] James P. O'gara, and Hilary Humphreys, S. epdermidis biofilms: Importance and Implications. *J Med. Micro*.- vol.50 (2001)..583-587.

[17] Kusuda, R. and Sugiyama A. Studies on the characters of *Staphylococcus epidermidis* isolated from diseased fishes. Part 1. On the morphological, biological and biochemical properties. *Fish Path. vol.* 16, (1981). 15-24.

[18] K.P Jithendran, M. Poornima, C.P. Balasubramanian and S. Kulasekarapandian Disease of Mud Crab in India, Bulletin No. XYZ, Institute of Brackish Water Aquaculture, Tamil Nadu, India (2009)..(http://www.scribd.com/doc/21584436/ Diseases-of-mud-crab-in-India)

[19] Lightner, D.V. and Lewis, D.H. A septicemic bacterial disease syndrome of penaeid shrimp. *Marine Fish. Rev. vol.* **37** (1975). (5-6): 25-28.

[20] Lavilla-Pitogo [a], C.R., Leano, E.M. and Paner, M.G. Mortalities of pond cultured Juvenile shrimp, Penaeus monodon, associated with dominance of luminescent bacteria, *Vibrio harveyi* in the rearing environment. *SICCPPS book of abstracts, SEAFDEC, Iloilo City, Philippines*. (1996). p. 40

[21] Lavilla-Pitogo[b], CR., Leano, EM., Paner, MG. Mortalities of pond-cultured juvenile shrimp *Penaeus monodon* associated with dominance of luminescent vibrios in the rearing environment. *Aquaculture* 164 (1998). 337–349.

[22] Lightner, D.V., Bell, T.A., Redman, R.M., Mohney, L.L., Natividad, J.M., Rukyani, A. and Poernomo, AA review of some major diseases of economic significance in penaeid shrimps/shrimps of the Americas and Indo-Pacific. In: M. Shariff, R. Subasinghe and J.R. Arthur (eds.) Proceedings 1st Symposium on Diseases in Asian Aquaculture. Fish Health Section, *AFS. Manila, Philippines*. . (1992). pp.57-80.

[23] Meyers, S. P.; Baslow, M. H.; Bein, S. J.; Marks, C. E. Studies of *Flavobacterium piscicida* Bein. I. Growth, toxicity, and

ecological considerations. *J. Bacteriology* 78, (1950). 225-230.

[24] Munro, P.D., Barbour, A. and Birkbeck, T.H. Comparison of the gut bacterial flora of start-feeding larval turbot under different conditions. *J. Appl. Bact.*77, (1994). 560–566.

[25] Maria Hoffmann , Markus Fischer , Paul Whittaker Evaluating the use of fatty acid profiles to identify deep-sea Vibrio isolates. *Food Chemistry* 122, (2010). 943–950.

[26] R. R. Colwell Polyphasic Taxo-nomy of the Genus Vibrio: Numerical Taxonomy of Vibrio cholerae, *Vibrio parahaemolyticus*, and RelatedVibrio Species. *J. Bact Vol. 104, No. I* (1970), p. 410-433

[27] P.O. Uaboi-Egbenni, P.N. Okolie, O. Famuyiwa and O. Teniola The Significance of Pathogenic Bacteria in the Gut of Swimming Crab, *Callinectes* sp Obtained from Lagos Lagoon and Market Samples Stored at Freezer Temperature (0oC). *Pak. J. Nutri.* 9 (4): (2010) 398-403,.

[28] Ringo, E., Strøm, E. and Tabachek, J.A.. Intestinal microflora of salmonids. A review. *Aquaculture Research* 26 (1995), 773–789.

[29] Spanggaard, B., Huber, I., Nielsen, J., Nielsen, T., Appel, K.F. and Gram, L. The microflora of rainbow trout: a comparison of traditional and molecular identification. *Aquaculture* 182, (2000). 1–15.

[30] Senderovich, Y., I. Izhak and M. Halpen Fish as reservoirs and vectors of viberio cholera. *PLoS One,* 5, (2010). e8607-e8607.

[31] Trust, T.J. and Sparrow, R.A.H. The bacterial flora in the alimentary tract of freshwater salmonid fishes. Canadian *J. of Microb.* 20, (1974). 1219–1228.

[32] Wang,. (Ch-2, Bacteria Fish Pathogen; Disease of Farmed and Wild Fish. By Brian Austun, Dawn A. Austun (1996) (http://books.google.com).

[33] Westerdahl, A., Olsson, J.C. and Kjelleberg, S. Isolation and characterization of turbot (Scophthalmus maximus)-isolated associated bacteria with inhibitory effects against Vibrio anguillarum. *Applied and Environmental Microbiology* 57, (1991). 2223–2228.

[34] Wong SY, Leong TS A comparative study of *Vibrio* infections in healthy and diseased marine finishes cultured in floating cages near Penang, Malaysia. *Asian Fisheries Science* 3, (1990). 353-359.

[35] Xiao and KumarSex ratio, and probability of sexual maturity of females at size, of the blue swimmer crab *Portunus pelagicus*, of southern Australia, *Fish. Res.*. **68**, , (2004). 271–282.

A Robust Regression: A Comparison Approach

L. Muhammad Safiih[1], D.A Anthea[2]
Mathematics Department, University Malaysia Terengganu, Kuala Terengganu, Terengganu, Malaysia
safiihmd@umt.edu.my[1],ann_peace87@yahoo.com[2]

Abstract
The use of past data is essential in forecasting some matter. Usually, the data that is being used are exposed to outliers. One of the useful methods to decrease the outliers' effect in forecasting is by implementing the robust approach. The outliers are known to be the barrier in forecasting the exchange rates data. The study of Robust Regression approach takes the USD/MYR exchange rates data. The scale estimation method is the base of the Robust Autoregressive (RAR) constructions. The good data (no outliers), 1%, 5% and 10% outliers are compared respectively by measuring their RMSE, MAD and MAE. Besides of having good predictability for exchange rate, the studies of RAR's model also indicate that the model is less sensitive on data extremity or outliers.

Keywords
Robust Regression, extreme data (outliers), Autoregressive.

INTRODUCTION

1971 marked the failure of The Bretton-woods system which was introduced in July 1944 (Preminger and Frank, 2007). Since then, much attention is afforded to exchange rates forecasting. It is important for every business, corporate members, academicians and those involved also to learn about forecasting exchange rates as it generally has relevance to the business in the financial markets. One of the problems often encountered in forecasting exchange rates is the existence of extreme data (outliers), which is indeed a great impact on exchange rates, thus it is important to establish a robust approach to reduce and try to overcome the problem faced. Therefore, robust regression approach will be used in the study of exchange rates.

In the financial system, an exchange rate is one important aspect. The exchange rate is a rate at which an order currency converted at each other. It is also known as a price (Copeland, 2005). For instance, the exchange rate for 26.4287 Japanese Yen (JPY, ¥) to 1 Malaysian Ringgit (MYR, RM) denotes the value of ¥26.4287 is equal to RM1.

Since 20 years ago, there's a development of interest and an encouraging observations in forecasting and modeling of exchange rates movement (Preminger & Frank, 2007). The existence of extreme data which is usually known as outliers is featured in the exchange rates data. Therefore, to reduce the impact of the outliers towards the regression estimator, the robust regression approach is applied to carry out investigation on predictability of GBP/USD and JPY/USD exchange rates data. Basically, Robust regression approach use an S-estimation method where S-estimator provides higher breakdown points towards the outliers besides of it's potential to make a better forecast. The result shows that the robust regression approach can improve the accuracy of the forecasting model.

Rousseeuw & Yohai (1984) states that S-estimator was far more efficient and less demand by assessment if compared to other robust estimator such as Least Median Square (LMS) method or Least Trimmed Square (LTS) method. Unlike LMS and LTS estimators, S-estimator descend according to smooth isolated observation, which have more natural characteristic from expertise point of view. Since it can prevent outliers until 50 percent in horizontal data, S-estimator is known as High breakdown Point (HBP) estimator. These shows that S-estimators do not break down easily when the data is contaminated.

Hund et al. (2002) finds that regression for Biweight (Tukey) function gets wider coverage compared to Biweight (Huber) regression. These findings are through Robustness tests according to sketch approach attempt. In further iteration, study discovers observation with larger error from certain hidden value (Threshold value), c, will be ignored. Therefore, weighting procedure only involve observation with small error form hidden value. With c=1.547 as hidden value, this mean all observation with $r_i > c$ in earlier iteration will not be considered in recent iteration. Study also found that the effect on data extreme (outliers) can be decreased by robust regression method that is decreasing the sensitivity towards extreme data. As robust regression method with Biweight (Tukey) function often shows similarity which is most approaching the Ordinary Least Square (OLS) estimator for original data set, it is most proposed.

The Mean Squared Error (MSE), the Mean Absolute Error (MAD) and the Root Mean Squared Error (RMSE) is then measured to assess the forecast accuracy. It was found that robust models tend to improve the forecast of AR model.

The next section discussed the research methods which suggest the robust autoregressive approach

based on the S-estimation method. The results and discussion are then reported in section 3 which shows the outcomes of the study. Section 4 discussed the summary and concludes the overall study.

Scope of the Study

Study limited to exchange rate data of Dollar US (USD) to Malaysian Ringgit (MYR). The samples used are beginning in January 1997 until March 2008 which involves 2786 exchange rates data which is the price for ending month achieved from Bank Negara.

Objectives

The objectives that wish to be achieved are:

i. To build forecasting model that are less sensitive to extreme dirtiness of data.
ii. To compare the sensitivity to outliers between two models; RAR and AR models.
iii. To determine the predictability of exchange rates by comparing RAR model to AR model.

RESEARCH METHOD

The ability of the robust regression model to reduce the extreme dirtiness of data through observation of past studies makes it a suitable model to be implemented in this study. To conduct studies of this model, S-estimation is chose as the method.

S-Estimation Method

As an alternative method for the ordinary least square estimation method, S-estimation method is used to obtain robust predictions. This measurement scale is an ordinary scale in the origin (Sakata & White, 2001). The findings predicted by using the Least Square method is similar to the findings predicted when using S-estimator, in the absence of data dirtiness. S-estimation method however, provides robust predictions for extreme data. From the breakdown class, S-estimator (Rousseeuw & Yohai, 1984) has variance estimator relation that is equal to the rate of convergence which is defined as minimization of remaining distribution:

Minimize $s(r_1(\theta),\dots,r_n(\theta))$ with the final scale estimation $\hat{\theta} = s\left(r_1(\hat{\theta}),\dots,r_n(\hat{\theta})\right)$. Dispersion of $s(r_1(\theta),\dots,r_n(\theta))$ is defined as the solutions to $\frac{1}{n}\sum_{i=1}^{n}\rho\left(\frac{r_i}{s}\right) = K$ (Gervini & Yohai, 2002). Normally, $K = E_{\Phi}[\rho]$ with Φ is standard normal. Functions ρ must fulfill the following conditions:

(C1) ρ is symmetrical and can be differentiated continuously, and $\rho(0) = 0$.

(C2) There are $c > 0$ thus that ρ is strictly increases in $[0,c]$ and constant on $[c,\infty)$.

(C3) $\frac{K}{\rho(c)} = \frac{1}{2}$. If there is more than one solution in $\frac{1}{n}\sum_{i=1}^{n}\rho\left(\frac{r_i}{s}\right) = K$, put together $s(r_1,\dots,r_n)$ equals to a set of supremum solutions, $s(r_1,\dots,r_n) = sup\left\{s;\left(\frac{1}{n}\right)\sum\rho\left(\frac{r_i}{s}\right)\right\} = K$. If no solution in $\frac{1}{n}\sum_{i=1}^{n}\rho\left(\frac{r_i}{s}\right) = K$, put $s(r_1,\dots,r_n)$ equal to zero, $s(r_1,\dots,r_n) = 0$.

The estimator, $s(r_1(\theta),\dots,r_n(\theta))$ known as S-estimator because it derived from the statistic scale by comprising method. Actually, s that is given in $\frac{1}{n}\sum_{i=1}^{n}\rho\left(\frac{r_i}{s}\right) = K$ is an M-estimator for scale. Clear that S-estimator is regression, scale and has equivalent variance relation. Because the condition (C2), $\psi(x) = \rho'(x)$ will always be valued at zero for some x, so ψ is dropping continuously.

To estimate for the model built, S-estimator is used with $\rho(\cdot)$ function which is derived from the Biweight (Tukey) function,

$$\rho(x) = \begin{cases} \frac{x^2}{2} - \frac{x^4}{2c^2} + \frac{x^6}{6c^4} & for\ |x| \le c \\ \frac{c^2}{6} & for\ |x| \ge c \end{cases} \qquad (2.1)$$

(Mokhtar Abdullah, 1994). Clear that $\rho(\cdot)$ function achieved supremum, $\bar{\rho}$ at $\bar{\rho} = \frac{1}{6}$ (Sakata & White, 2001). In the case of (2.1) with $K = E_{\Phi}[\rho]$, it can be achieved by taking $c = 1.547$. Now look at the scale estimator $s(r_1,\dots,r_n)$ which is defined by $\frac{1}{n}\sum_{i=1}^{n}\rho\left(\frac{r_i}{s}\right) = K$ for any sample $(r_1,\dots,r_n)$. For each ρ that is eligible with C1, C2 and C3 conditions, and for each n, there is a positive constant, α and β thus as S-estimator that is given by (2.1) which satisfy

$$\alpha \underset{i}{med}|r_i| \le s(r_1,\dots,r_n) \le \beta \underset{i}{med}|r_i| \qquad (2.2)$$

From (2.2), med_i or $s(r_1,\dots,r_n)$ may be zero. For each $\theta \in \Theta$ and (y_i,x_i), $i = 1,2,\dots,n$ sample, the definition of measurement scale for the remaining are as follows:

$S(\theta) =$

$sup\left\{s \in \Re_{++}: \frac{1}{n}\sum_{i=1}^{n}\rho\left(\left(y_i - h(x_i,\theta)\right)/s\right) = K\right\}$

with $\Re_{++} = (0,\infty)$; $r_i = y_i - h(x_i,\theta)$; $K \in \left(0,\frac{1}{2}\bar{\rho}\right)$; $s(\theta) = 0$ if the equation has no solution.

S-estimator, $\hat{\theta}_n^S$ is defined as

$\hat{\theta}_n^S = \arg\min_{\theta\in\Theta} S(\theta) = \arg\min_{\theta\in\Theta} sup\left\{s \in \Re_{++}: \frac{1}{n}\sum_{i=1}^{n}\rho\left(\left(y_i - h(x_i,\theta)\right)/s\right) = K\right\}$

. $\hat{\theta}_n^S$ is used to build a robust regression model, that is a Robust Linear Autoregressive Model (RAR).

Robust Linear Autoregressive Model (RAR)

Robust Linear Autoregressive Model (RAR) is build and interpreted using the S-estimation procedure because of its sensitivity towards extreme data. To obtain the series returns for forecasting exchange rates, regression model is estimated based on follow-

up returns. The following Linear Autoregressive Model is considered: $r_t = \alpha + \sum_{t=1}^{p} \beta_t r_{t-t} + \varepsilon_t$. Replace $\frac{x^2}{2} - \frac{x^4}{2c^2} + \frac{x^6}{3c^4}$ function in $r_t = \alpha + \sum_{t=1}^{p} \beta_t r_{-t} + \varepsilon_t$ if $|x| \leq c$, and replace $\frac{c^2}{6}$ function in $r_t = \alpha + \sum_{t=1}^{p} \beta_t r_{t-t} + \varepsilon_t$ if $|x| \geq c$.

Data Comparison

Below are the forecast statistical error which is defined in order to assess forecast accuracy:

i. Root mean Square Error (RMSE), $\sqrt{\frac{1}{n}\sum_{\tau=t+1}^{t+n}(r_\tau - \hat{r}_\tau)^2}$

ii. Mean Absolute Error (MAE), $\frac{1}{n}\sum_{\tau=t+1}^{t+n}|r_\tau - \hat{r}_\tau|$

iii. Median of Absolute Deviation (MAD), $median(|r_\tau| - median(r_\tau))$

Where, r_τ is an actual value and $\hat{r}_\tau$ is predicted return with time, τ.

The results comparison between the original data with data of which stained by 1%, 5% and 10% is then implemented to show that the Robust Autoregressive (RAR) Model is more sensitive to outliers than the Autoregressive (AR) Model. The stained data of 1%, 5% and 10% represents lower breakdown point, medium breakdown point and higher breakdown point respectively.

RESULTS AND DISCUSSION

The findings of the study obtained from a study which was being conducted on exchange rates currency of US Dollar to Malaysian Ringgit (USD/MYR) will be discussed in this section. Study finding results are based on the objectives which stated earlier on.

Robust Forecasting Model (RAR)

Table 1: Robust Autoregressive Model

Regression Model- Linear Autoregressive Model	Condition
$r_t = \alpha + \sum_{t=1}^{p} \beta_t r_{t-t} + \varepsilon_t$	$\|x\| \leq c$ $c = 1.547$
	$\|x\| \geq c$ $c = 1.547$

Table 1 shows the construction of robust regression model. The first column is a Linear Autoregressive (AR) Model before it is added with robust elements. Robust element that is meant here is a result from processing towards scale estimator (S-estimator) methods of which $r(\cdot)$ functions is derived from Biweight (Tukey) estimator. Both row in the second column shows the condition where the absolute value of x must be smaller or equal and greater or equal to the value c respectively. The value of estimator can be achieved by taking the value $c = 1.547$ (Rousseeuw & Yohai, 1984). Selection value c is also due to the breakdown point of 50%.

Sensitivity Forecasting Model (RAR) Towards Extreme Data.

Results study found that robust forecasting model (RAR) is less sensitive to extreme data.

Table 2(a): results of statistics forecasting for the linear Autoregressive (AR) model for the original data of exchange rate of US Dollar towards Malaysian Ringgit (USD/MYR).

RMSE	MAE	MAD
0.0215258	0.01489911	0.005004086

Table 2(a) shows the results of statistical forecasting that will be compared with results in Table 2(b) to determine the forecasting ability of USD/MYR exchange rates currency.

Table 2(b): Sensitivity of robust Autoregressive Model towards extreme data (bad data) for the exchange rates of US Dollar towards Malaysian Ringgit (USD/MYR) currency.

bad data (%)	Statistical Forecasting method		
	RMSE	MAE	MAD
1	0.01599138	0.008836909	0.005670747
5	0.01257981	0.006704341	0.004469122
10	0.00664021	0.004110636	0.002824626

Table 2(b), reveal that the high breakdown point (bad data=10%) gives the smallest error value in three statistical forecasting values (RMSE, MAE, MAD). This was followed by a middle breakdown point (bad data=5%) and finally the low breakdown point (bad data=1%).

The test to determine whether the sensitivity of the model built is high or low towards extreme of the data can be viewed through three statistical forecasting methods respectively as in Table 2(a) and Table 2(b) that is RMSE, MAE and MAD. The exchange rates data of USD/MYR which has been firmed using robust model built was stained by 1%, 5% and 10%. Furthermore, comparison can be made by observing at the error values obtained when tested at a low breakdown point, medium breakdown point and high breakdown point.

Small value of the error on the high breakdown point clearly proves that the model constructed has a low sensitivity to extreme data. Meanwhile, the value of the error that is greater at the low breakdown point proves that the model built has a high sensitivity to extreme data. Therefore, it can be concluded that the Robust Autoregressive model built is less sensitive to extreme data thus show that estimation based on robust models can improve the performance of a forecasting model used.

Forecasting Predictability of Exchange Rate

In the context of exchange rates, forecasting ability means prediction accuracy that can be obtained through the model used. The smaller error values obtained the closer to the real solution, therefore more accurate prediction obtained.

Forecasting ability for the exchange rate are identified by comparing towards the value of statistical forecasting of the original data with robust data (stained data). Table 2(a) and 2(b) reveal that the forecasting accuracy of Robust Autoregressive model is better than the Linear Autoregressive model.

For the original data (Table 2(a)), the value of statistical forecasting are as follows: RMSE = 0.0215258, MAE = 0.01489911, and MAD = 0.005004086. For robust data (Table 2(b)), for 1% bad data; RMSE, MAE and MAD are 0.01599138, 0.008836909 and 0.005670747 respectively. Meanwhile, for 5% bad data; RMSE, MAE and MAD are 0.01257981, 0.006704341, and 0.004469122 respectively. Meanwhile, the value of RMSE, MAE and MAD to 10% bad data are respectively 0.00664021, 0.004110636 and 0.002824626.

The error values obtained for the original data is greater compared to the values for statistical forecasting for robust data that has been stained. Therefore, the forecasting ability for the exchange rates are good if using Robust Autoregressive model for giving a more precise value where the value of the error obtained is small even with the increase of extreme data.

CONCLUDING REMARKS

Forecasting model of robust regression (RAR) was built by using S-estimator with $r(.)$ derived from Biweight (Tukey) function which is $\eta_i = \frac{x^2}{2} - \frac{x^4}{2c^2} + \frac{x^6}{6c^4}$ if the condition $|x| \leq c$ are filled and $\eta_i = \frac{c^2}{6}$ if the condition $|x| \geq c$ met. η_i value that meets the conditions will be impure with linear Autoregressive (AR) model which is the original model that will eventually form the robust regression (RAR) model. In addition, research finding results also concluded that Robust Autoregressive Model which has been built is less sensitive to extreme data (outliers). From these findings, it can be concluded that the estimation based on robust model can improve performance for a forecasting model used.

Besides that, results from the study also concluded that the RAR model can assess the forecasting ability in terms of prediction accuracy based on the three forecasting methods (RMSE, MAE, and MAD), where MAD give the smallest value when tested with data that has been firmed by RAR model for the exchange rate of USD/MYR.

REFERENCES

[1] Copeland, L.: *Exchange rates an international finance*. Prentice-Hall (2005).

[2] Gervini, D., & Yohai, V.J.: A class of robust and fully efficient regression estimators. *The Annals of Statistics*, 30: 583 – 616 (2002)..

[3] Hund, E., Massart, D.L., Verbeke, J.S.: Robust regression and outlier detection in the evaluation of robustness tests with different experimental designs. *Analytica Chimica Acta*, 463: 57-73 (2002). (1990).

[4] Mokhtar Abdullah.: *Analisis Regressi*. Dewan Bahasa dan Pustaka Kementerian Pendidikan Malaysia: Kuala Lumpur (1994).

[5] Preminger, A., & Franck, R.: Forecasting exchange rates: a robust regression approach. *International Journal of Forecasting*, 23: 71 84 (2007).

[6] Rousseeuw, P.J., & Yohai, V. J.: Robust regression by means of S-estimators. In W. H. Franke, & R. D. Martin (Eds.), *In robust and nonlinear time series analysis* New York: Springer Verlag. pp.256-272 (1984).

[7] Sakata, S., & White, H.: S-estimation of nonlinear regression models with dependent and heterogeneous observativations. *Journal Econometrics*, 103: 5-72 (2001).

Selection Principle in Fuzzy Topological Space

Mazlina Muzafar Shah[1], Abd. Fatah Wahab[2]
[1,2] Department of Mathematics, University of Malaysia Terengganu, 21030 Kuala Terengganu, Malaysia
E-mail: mazkck@yahoo.com.my[1], fatah@umt.edu.my[2]

Abstract
There have three type of selection principle that have been introduced in topological field which is $S_{fin}(A,B)$, $S_1(A,B)$ and $U_{fin}(A,B)$. These types of selection principle have been considered in crisp topologies space. In this paper, by using Chang's fuzzy topology (1968), we will fuzzified selection principle. In addition we also will introduce fuzzy covering space and further we will discuss the relationship between fuzzy covering space and fuzzy selection principle. Hazra et.al find that in Chang fuzzy topology is lacking of openness, so they have introduced a new concept which is gradation of topological space where the collection of fuzzy subset will have gradation of openness (closedness). Thus, from this initiative we introduced a concept of gradation of covering space and gradation of selection principle. Then, we will also discuss the relation ship between these two concepts.

Keywords
Fuzzy set, Chang's fuzzy topology, fuzzy covering space, fuzzy selection principle, gradation of topological space, gradation of covering space, gradation of selection principle.

INTRODUCTION

Since Zadeh (1965) introduced a concept of fuzzy set and fuzzy topology by Chang (1968), many concepts in topology have been converting to fuzzy topology. The reader can refer to (Wong, 1973a; 1973b; Lowen, 1976; Pu & Liu, 1980; Chakraborty & Ahsanullah, 1992).

In general, a function $f: X \to Y$ is called covering projection if every $y \in Y$, there exist an open neighborhood V_y such that $f^{-1}(V_y)$ is a disjoint union of open sets each of which is homeomorphic by f to V_y. X is called covering space and Y is the base space of the covering projection. (the reader can refer the book Kosnioviski, 1980; Hatcher, 2002).

The research about selection principle in mathematics has been discussed generally with the problem that has been appeared in *Selection Principle in Mathematics (SPM)*. There believe that the combination of measure theory and metric space theory that produce selection principle in topology. The entire summary about selection principle the reader can refer to Scheeper (2003). In 1924, Menger have defined basic Menger property for metric space. Therefore from Menger assumption, Hurewicz (1925) have derived $S_{fin}(A,B)$ and $U_{fin}(A,B)$. Another type of selection principle is $S_1(A,B)$ where have been introduced by Rothberger (1938) in his research about Borel measure zero (1919).

In this paper our first objective we would like to introduced selection principle in perspective fuzzy topology and also we will introduce fuzzy covering space. Then, we will discuss the relationship between fuzzy covering space and fuzzy selection principle.
Meanwhile, Hazra et.al (1992a; 1992b) have find that Chang's fuzzy topology is lacking of openness (closedness), so they decided to introduced a concept of gradation of openness of a fuzzy of X by a mapping $\tilde{\tau}: I^X \to I$ where $I = [0,1]$ satisfy three condition. Abu Osman & Abd. Fatah (1999) in their research proposed some new concept of gradation mapping.

So, our next objective is to introduce a concept of gradation of covering space and gradation of selection principle. In addition, we also discuss the relationship between both concepts.

PRELIMINARIES

Fuzzy set theory

Definition 2.1 (Zadeh, 1965).
A fuzzy set $A \subset X$ is a set of ordered pairs which defined
by:

$$\tilde{A} = \{(x, \mu_A(x)) \mid x \in X\}$$

where $\mu_A(x): X \to [0,1]$ represent membership function or grade of membership (also degree *f* compatibility of degree of truth) of *x* in the fuzzy set *A*.

Fuzzy operation

Definition 2.2
Let $A, B \subset X$. Then $\forall x \in X$

$$\tilde{A} = \tilde{B} \Leftrightarrow \mu_A(x) = \mu_B(x)$$
$$\tilde{A} \subseteq \tilde{B} \Leftrightarrow \mu_A(x) \le \mu_B(x)$$
$$C = \tilde{A} \cup \tilde{B} \Leftrightarrow \mu_C(x) = \max\{\mu_A(x), \mu_B(x)\}$$
$$D = \tilde{A} \cap \tilde{B} \Leftrightarrow \mu_D(x) = \min\{\mu_A(x), \mu_B(x)\}$$
$$E = A' \Leftrightarrow \mu_E(x) = 1 - \mu_A(x)$$

Fuzzy mapping

Definition 2.3 (Zadeh, 1972)

A fuzzy mapping $f: X \to Y$ is a fuzzy set on $X \times Y$ with membership function $\mu_f(x, y)$. A fuzzy function *f(x)* is a fuzzy set on Y with membership function

$$\mu_{f(x)}(y) = \mu_f(x, y)$$

Its inverse $f^{-1}(y)$ is a fuzzy set on X with

$$\mu_{f^{-1}(y)}(x) = \mu_f(x, y)$$

Fuzzy continuous function

Definition 2.4 (Chang, 1968)

Let $f: X \to Y$ and $\widetilde{B} \subset Y$ with membership function $\mu_B(y)$. Hence, the inverse of $\widetilde{B}$, $f^{-1}(\widetilde{B}) \subset X$ which membership function defined by

$$\mu_{f^{-1}(B)}(x) = \mu_B(f(x)), \forall x \in X$$

Conversely, let $\widetilde{A} \subset X$ with membership function $\mu_A(x)$. The image of $\widetilde{A}$, $f(\widetilde{A}) \subset Y$ which membership function is given by

$$\mu_{f(A)}(y) = \begin{cases} \sup_{z \in f^{-1}(y)} \{\mu_A(z)\}, & \text{if } f^{-1} \neq \phi \\ 0 & \text{otherwise} \end{cases}$$

$\forall y \in Y$, where $f^{-1}(y) = \{x \mid f(x) = y\}$

Fuzzy topological spaces

Definition 2.5 (Chang, 1968).

A fuzzy topology on a set X is a collection $\widetilde{\tau}$ of fuzzy sets in X satisfying:

i) $\phi, X \in \widetilde{\tau}$

ii) If $\widetilde{A}, \widetilde{B} \in \widetilde{\tau}$, so $\widetilde{A} \cap \widetilde{B} \in \widetilde{\tau}$

iii) If $\widetilde{A}_i \in \widetilde{\tau}, \forall i \in I$, so $\bigcup_{i \in I} \widetilde{A}_i \in \widetilde{\tau}$.

If $\widetilde{\tau}$ is fuzzy topology on X then the pair $(X, \widetilde{\tau})$ called fuzzy topological space (fts).

Definition 2.6

Let $(X, \widetilde{\tau})$ be a fts. Given two subsets $I = \{1,2,...,m\}$ and $J = \{1,2,...,n\}$ of integers. A fuzzy covering of $\widetilde{A}$ means a family of fuzzy set A or collection of fuzzy set A, $\{\widetilde{A}_i\}$ that is $\widetilde{A}_i = \{(i, \mu_j(i)) : i \in I\}$ where $\mu_j(i) \in [0,1]$ with $\widetilde{A}$ being the union of its elements.

$$\bigcup_{i \in I} \widetilde{A}_i = \widetilde{A}$$

It is a fuzzy open cover if and only if each member of $\widetilde{A}$ is a fuzzy open set. A fuzzy subcover of $\widetilde{A}$ is a subfamily which is also a fuzzy cover.

Concept of Gradation

Definition 2.7 (Hazra et.al, 1992b)

Let $\widetilde{\tau}: I^X \to I$ be a mappings where satisfying the following properties:

(O1) $\widetilde{\tau}(0) = \widetilde{\tau}(1) = 1$;

(O2) $\widetilde{\tau}(\mu_1 \cap \mu_2) \geq \widetilde{\tau}(\mu_1) \wedge \widetilde{\tau}(\mu_2)$;

(O3) $\widetilde{\tau}(\cup \mu_i) \geq \wedge\, \widetilde{\tau}(\mu_i)$

Then, $\widetilde{\tau}$ in this case will know as *gradation of openness* on X and $(X, \widetilde{\tau})$ graded topological space.

Definition 2.8

Let $\widetilde{\psi}: I^X \to I$ be a mappings where satisfying the following properties:

(C1) $\widetilde{\psi}(0) = \widetilde{\psi}(1) = 1$;

(C2) $\widetilde{\psi}(\mu_1 \cup \mu_2) \geq \widetilde{\psi}(\mu_1) \wedge \widetilde{\psi}(\mu_2)$;

(C3) $\widetilde{\psi}(\cap \mu_i) \geq \wedge\, \widetilde{\psi}(\mu_i)$

Then, $\widetilde{\psi}$ will know as *gradation of closedness* on X.

Definisi 2.9 (El-Gayyar et.al,1994)

Let $(X, \widetilde{\tau})$ be a gradation of topological space and $\mu \in I^X$. Thus the $\widetilde{\tau}$-closure for μ denoted by $\overline{\mu}$ is defined by

$$\overline{\mu} = \bigcap \{\nu \in I^X \mid \nu \supseteq \mu, \widetilde{\psi}_{\widetilde{\tau}}(\nu) \geq \widetilde{\psi}_{\widetilde{\tau}}(\mu)\}$$

dan pendalaman-$\widetilde{\tau}$ bagi μ disimbolkan sebagai μ° ditakrifkan sebagai

$$\mu^\circ = \bigcup \{\nu \in I^X \mid \nu \subseteq \mu, \widetilde{\tau}(\nu) \geq \widetilde{\tau}(\mu)\}$$

FUZZY SELECTION PRINCIPLE

We have review early about selection principle in term of topology. Now we will introduce selection principle in fuzzy topology field which is named as fuzzy selection principle. This fuzzy selection principle is in Chang's fuzzy topology which satisfied the three conditions (definition 2.5).

Definition 3.1

$\widetilde{S}_{fin}(\widetilde{A}, \widetilde{B})$: For each fuzzy sequence $\{\widetilde{A}_i\}$ of element of $\widetilde{A}$, there is a fuzzy sequence finite set $\{\widetilde{B}_i\}$ such that for each $i \in I$, $\widetilde{B}_i \in \widetilde{A}_i$ and $\bigcup \{\widetilde{B}_i : i \in I\} \in \widetilde{B}$.

Definition 3.2

$\widetilde{S}_1(A,B)$: For each element in fuzzy sequence $\{\widetilde{A}_i\}$ there is a fuzzy sequence $\{\widetilde{B}_i\}$ that is for each $i \in I$, $\widetilde{B}_i \in \widetilde{A}_i$ and $\{\cup \widetilde{B}_i : i \in I\} \in \widetilde{B}$.

Definition 3.3

$\widetilde{U}_{fin}(\widetilde{A},\widetilde{B})$: For each element in fuzzy sequence $\{\widetilde{A}_i\}$ where doesn't have fuzzy finite subcover, there have a fuzzy sequence finite set $\{\widetilde{B}_i\}$ that is for each $i \in I$, $\widetilde{B}_i \subseteq \widetilde{A}_i$ and $\{\cup \widetilde{B}_i : i \in I\}$ is element of $\widetilde{B}$.

Some properties of fuzzy selection principle

Let $\widetilde{A}$ and $\widetilde{B}$ is a collection of fuzzy cover (definition 2.6). We must remember that the collection of fuzzy cover is in sequence form (refer the definition fuzzy selection principle above). For now, we will consider both fuzzy cover are in same case. We will give three scenarios that is consider $\widetilde{A}$ and $\widetilde{B}$ are fuzzy open cover, fuzzy closed cover and fuzzy clopen (semi-open) cover.

FUZZY COVERING SPACE

If two fuzzy selection principle that having same type, then there exist a function between them. Since there exist a function between two fuzzy selection principle, it follows there exist a fuzzy covering function or fuzzy covering projection. So, we also introduced a concept of fuzzy covering space in this paper.

Definition 4.1

Let $(X,\widetilde{\tau})$ and $(Y,\widetilde{\sigma})$ be a fts. Consider $f : X \to Y$ fuzzy continuous function. f is a fuzzy covering projection or also known as fuzzy covering function if $\forall y \in Y, \exists \widetilde{V}_y$ (fuzzy open neighborhood of y) such that $f^{-1}(\widetilde{V}_y)$ disjoint union of fuzzy open set A in X each of which is fuzzy homeomorphic (two space with fuzzy homeomorphism) by f to $\widetilde{V}_y$. X will know as fuzzy covering space. Meanwhile Y will known as fuzzy base space.

Theorem 4.1

Every fuzzy covering function $f : X \to Y$ is open.

Theorem 4.2

If $f : X \to Y$ is a fuzzy covering function then Y has the quotient fuzzy topologies with respect to f.

Theorem 4.3

If Y is fuzzy locally connected then a fuzzy continuous function $f : X \to Y$ is a fuzzy covering function if and only if for every component H of Y, the function

$$f \mid f^{-1}(H) : f^{-1}(H) \to H$$

is a fuzzy covering function.

GRADATION OF COVERING

As we have review some concept of gradation where we know that Chang's fuzzy topology is lacking of openness (closedness) at fuzzy subset of X. We need to derived or introduced gradation of covering so that this concept will need use for next concept which is gradation of selection principle. For this section we will discuss the definition and also the properties.

Definition 5.1

Let $\mu \in I^X$ and $(X,\widetilde{\tau})$ be graded topological space. μ is called *gradation of covering* if and only if the collection $\{\mu_\alpha \mid \alpha \in I\} \subseteq \mu$ have the gradation of openness (closedness) (definition 2.7 & definition 2.8)

$$\bigcup_{\alpha \in I} \mu_\alpha = \mu$$

with μ being the union of its graded elements.

Theorem 5.1

Let $\widetilde{\tau}(\mu)$ be a gradation of open cover. Then, the finite intersection of $\widetilde{\tau}(\mu)$ is also gradation of open cover.

Theorem 5.2

Let gradation of open (close) cover sequence $\{\widetilde{\tau}_\beta \mid \beta \in I\}$ be an increasing sequence on X. Then $\vee\{\tau_\beta \mid \beta \in I\}$ is a gradation of open cover on X.

GRADATION OF SELECTION PRINCIPLE

Definition 6.1

$\widetilde{S}_{fin}(\mu,\lambda)$ where $\mu,\lambda \in I^X$ is said to be graded selection principle if each $\{\mu_\alpha \mid \alpha \in I\}$ there is a $\{\lambda_\alpha \mid \alpha \in I\}$ where λ finite such that for each $\alpha \in I$, $\lambda_\alpha \subseteq \mu_\alpha$ if and only if $\lambda \leq \mu$ and $\bigcup\{\lambda_\alpha : \alpha \in I\} \in \lambda$.

Definition 6.2

$\widetilde{S}_I(\mu,\lambda)$ where $\mu,\lambda \in I^X$ is said to be graded selection principle if each $\{\mu_\alpha \mid \alpha \in I\}$ there is a $\{\lambda_\alpha \mid \alpha \in I\}$ that is for each $\alpha \in I$, $\lambda_\alpha \in \mu_\alpha$ if $\lambda \leq \mu$ and $\bigcup\{\lambda_\alpha : \alpha \in I\} \in \lambda$.

Definition 6.3

$\widetilde{U}_{fin}(\mu,\lambda)$ where $\mu,\lambda \in I^X$ is said to be graded selection principle if each $\{\mu_\alpha \mid \alpha \in I\}$ where doesn't have finite gradation of subcover, there have finite set $\{\lambda_\alpha \mid \alpha \in I\}$ that is for each $\alpha \in I$, if and only if $\lambda \leq \mu$ and $\bigcup\{\lambda_\alpha : \alpha \in I\} \in \lambda$.

GRADATION OF COVERING SPACE

If the gradation selection principle is the same type, then there exists function between them. Since there exist a function, it follows that there exist gradation of covering mapping or gradation of covering projection. In this section we have use research from Abu Osman & Abd. Fatah (1999) as our main methodology.

Definition 7.1

Let $(X,\tilde{\tau})$ and $(Y,\tilde{\sigma})$ is gradation of topological spaces. Consider $f:X\to Y$ is continuous mapping. f is gradation of covering projection or also known as gradation of covering mapping if for every $y\in Y$ there exist gradation of openness neighbourhood N_λ where $N_\lambda \in I^Y$, such that $f^{-1}(N_\lambda)$ disjoint union of gradation of openness set $\tilde{\tau}(\mu)$ where $\mu\in I^X$ in X and each of which is homeomorphic by f to N_λ. Thus, X will know as gradation of covering space. Meanwhile Y will known as gradation of base space.

The gradation of covering mapping have four main properties.

- Gradation of contraction covering map
- Gradation of expansion covering map
- Gradation of fixing covering map
- Gradation of preserving covering map

CONCLUSION

In this section, we will discuss the relationship between fuzzy covering space and fuzzy selection principle and also relationship between gradation of covering space and gradation of selection principle. Both of them having same relationship which is if the selection principles have same type, then there exist a function between them and the function is covering function or covering projection. The different is we have look at two different aspect which is fuzzy aspect and gradation aspect.

ACKNOWLEDGMENTS

I want to thanks to my sponsorship UMT especially GS (Graduate School) department because concern and show their support. I also want to thanks my supervisor, Dr.Abd.Fatah that being so supportive and encouraged me to involve this conference so that i can get experience, advice and also comment for guidelines in this new research.

REFERANCES

[1] Abu Osman & Abd Fatah. 1999. Penggredan pada ruang topologi kabur. Sains Malaysiana 28 (1999) 151-159.

[2] Borel, E. Sur la classification des ensembles de mesure nulle. *Bulletin de laa Societe Mathematique de France* 47 (1919) 97-125.

[3] Chang, C. L. Fuzzy topological space. *J. Math. Anal. Appl.* 24 (1968) 97-105.

[4] Chakraborty, M. K. & Ahsanullah, T. M. G. Fuzzy topology on fuzzy sets and tolerance topology. *Fuzzy Sets and Systems* 45 (1992) 103-108.

[5] El-Gayyar, M. K., Kerre, E.E. & Ramadan, A. A. Almost compactness and near compactness in smooth topological spaces. Fuzzy Sets and Systems 62 (1994) 193-202.

[6] Hazra, R. N., Samanta, S. K. & Chattopadhyay, K. C. 1992a. Fuzzy topology redefined. Fuzzy Sets and Systems 45 (1992a) 78-82.

[7] Hazra, R. N., Samanta, S. K. & Chattopadhyay, K. C. Gradation of openness: fuzzy topology. Fuzzy Sets and Systems 49 (1992b) 237-242.

[8] Hurewicz, W. Über die Verallgemeinerung des Borelschen Theorems. *Mathematische Zeitschrift* 24 (1925) 401-425.

[9] Hatcher, A. *Algebraic Topology*. Cambridge University Press (2002) Cambridge.

[10] Kosniovski, C. *A first course in Algebraic Topology*. Cambridge University Press. (1980)

[11] Lowen, R. Fuzzy topological space and fuzzy compactness. *J. Math. Anal. Appl.* 56 (1976) 621-633.

[12] Menger, K. Einige Überdeckungssätze der Punltmengenlehre, Sitzungsberichte Abt. 2a. *Mathematik, Astronomie, Physik, Meteorologie und Mechanik (Wiener Akademie, Wien)* 133 (1924) 421-444.

[13] Pu Pao-Ming & Liu Ying-Ming. Fuzzy topology I: neighbourhood structure of fuzzy point and Moore-Smith convergence. *J. Math. Anal. Appl.* 76 (1980) 571-599.

[14] Rothberger, F. Eine Verschärfung der Eigenschaft. *C. Fund. Math*. 30 (1938) 50-55.

[15] Scheepers, M. Selection principles and covering properties in topology. Note di Matematica 22 (2003) 3-41

[16] Wong, C. K. Covering properties of fuzzy topological spaces. *J. Math. Anal. Appl*. 43 (1973a) 697-704.

[17] Wong, C. K. Fuzzy points and local properties of fuzzy topology. *J. Math. Anal. Appl.* 46 (1973b) 316-328.

[18] Zadeh, L. A. Fuzzy sets. *J. Inform. Control* 8 (1965) 338-353.

Why People Perform Transactions with the Government Online: An Integrative Framework

Ayankunle Adegbite Taiwo and Alan Giffin Downe
[1]Universiti Technology Petronas
kunletaiwong@gmail.com, alan_downe@petronas.com.my

Abstract
The use of e-government has been widely accepted by most developed countries. Efforts made by developing nations to implement e-government services have been a mixture of success and failure. This study aims to investigate and evaluate each determinant factor that influences the decision to use e-government services within specific service domains. This paper presents an integrative framework for technology acceptance research. Attitude towards computer, Trust and individual personality related context were introduced to extend the Unified Theory of Acceptance and Use of Technology (information system specific belief context). The framework is proposed to give the best description of the sample being examined. This research model is being tested in both Malaysia and Nigeria. The services under investigation are e-service applications within the immigration, procurement and the Vehicle Registration departments.

Keywords
E-government, Trust, Personality, Attitude, UTAUT.

INTRODUCTION

E-Government can be described as the use of information and communications technologies to improve services provided by government to its citizens (Jain, 2004). According to AlAwadhi & Morris (2008) fewer e-government studies have taken place on developing countries. Failure of some e-government initiatives in developing countries of Africa arose "particularly because e-government concepts and designs have their origins in the West; origins that are significantly different from African realities" (Heeks, 2002). Aichholzer (2004) suggested that planning and adequate assessment of citizens' e-readiness should precede implementation of e-government services for adoption. Such adequate planning and readiness is inadequate in most Sub Sahara African (SSA) countries.

Furthermore, little attention has been given to studies on e-government in SSA communities. Dode (2007) recommended reassessment of e-government preparedness in Nigeria after iterating some challenges such as Internet accessibility, electricity supply, trust in government and computer literacy etc. Some of the challenges could influence the behaviour of the people towards the adoption of the provided government e-services as most of the available e-services are underutilised.

Asia-Pacific governments had adopted e-government systems, but they are still behind in rates of adoption when compared with the adoption of many private businesses in the region. In addition to Heeks's reality- design gaps affecting developing nations, Liu (2008) discussed challenges facing Asia pacific e-government as: citizens concerns about security; confidentiality of information; obsolete regulations and laws; lack of understanding and computer skills; concern by authoritarian regimes over increased information flow and citizen participation.

Despite early impact of e-government initiatives, Malaysia still faces some challenges in moving to a higher level of impact and maturity. Raman, Kaliannan and Yu (2007) related the low adoption of some e-government applications to "lack of integration and insufficient engagement of key stakeholders (users and citizens)". Furthermore, some e-government initiatives such as the Telehealth and some other initiatives have been unsuccessful (Raman et al., 2007).

Therefore, it is important to investigate citizens' attitude towards the adoption of e-government in developing countries, as there are few empirical studies into this area within either the African or Asian context. Avgerou (2008) suggested that information systems (including e-government) research in developing countries would contribute to understanding information systems innovation and its development consequences across the world.

Why do people use e-services?

The main research question for this study is "what determining factors influence adopters of e-government services within the community of two developing nations; Malaysia and Nigeria?'

LITERATURE REVIEW

Unified Theory of Acceptance and Use of Technology (UTAUT)

The UTAUT is a unified model that was developed by Vankatesh et al (2003) based on socio-cognitive theory with a combination of eight prominent Information Technology (IT) acceptance research models. The eight models comprising the UTAUT are: the theory of reasoned action, the technology acceptance model, the motivational model, the theory

of planned behaviour, a model combining the technology acceptance model and the theory of planned behaviour, the model of PC utilization, the innovation diffusion theory, and the social cognitive theory. Similarities in the empirical validation gave birth to the new UTAUT model which has been subsequently argued to be the benchmark in the industry for acceptance literature. Key constructs in the UTAUT include:

- ***Performance Expectation:*** Performance expectation is the degree to which an individual believes that using a computerised system will assist him or her in increasing his or her job performance.
- ***Effort Expectancy****:* Effort expectancy is the degree of ease associated with use of the computer systems
- ***Social Influence:*** Social Influence is the degree to which an individual sees that important others believe he should use the new computer system or technology.
- ***Facilitating conditions****:* Facilitating conditions are the degree to which an individual believes that organizational and technical infrastructures are available to support the use of the system (Venkatesh et al., 2003).

Attitude towards Computer

Attitude toward computer Usage ATCUS and v.2.0
The attitude towards computer (ATCUS) scale was invented by Popovich et al (1987) to scrutinize peoples' mind-set towards the use of computers and technologies that are related to computing. ATCUS consist of 20 items that are structured to unveil the reactions to computers, behavioural beliefs about computers and other related computing technologies. The initial ATCUS has four key subscales namely: negative reaction to computers, positive reaction to computers, computers/children education and reaction to computer related technologies. Morris et al (2009) updated ATCUS to v.2.0, following the guide from Clark& Watson (1995) on developing new scales. The new scale has validity and reliability than its predecessor. Negative / positive reactions to computers were found to be more suitable to this study.

Individual Personality trait

Openness: This is one of the key constructs of the five factor personality dimensions. Openness refers to an individual willingness to accept and welcomes various experiences, culture, always express curiosity and high level of imagination (Costa &McCrae (1992). Furthermore, behavioural flexibility and alternative attitudes are some of human attributes that reflects openness to experience. Some studies suggest that open-minded individual tends to be technology adopters (Wang et al 2006).

Risk – taken propensity: According to Gupta et al (2004), risk-taken propensity is the inclination for a person to avoid or take risk. Studies have shown that individuals with high risk predisposition have the tendency of adopting new technology better than individuals with low risk predisposition (Wang et al 2006; Sitkin &Pablo 1992).

Web Trust

A multidimensional model of trust was introduced into use of e-commerce by McKnight, Choudhury, and Kacmar (2002).The authors argued that trust-related behaviour can be directly influenced by one's trust intention according to the theory of reasoned action (TRA). The willingness of a person to depend on another is called Trust Intentions. Furthermore, an individual's trust intention is determined by the relation of three constructs, disposition to trust, institution-based trust and trust beliefs:

- ***Disposition to Trust:*** Disposition to trust is an individual's tendency to be willing to depend on others
- ***Institution Based trust:*** Institution-based trust is the level to which an individual believes structural conditions are good enough to support his or her success.
- ***Trust Beliefs:*** Trust beliefs are an individual's confidence that the trade partner shall fulfil his or her transactional obligations as expected by the member.

In conclusion, the intention to trust implies that "the truster is securely willing to depend, or intends to depend, on the trustee" (McKnight et al., 2002). Disposition to trust, institution based trust and trust beliefs are suggested to have significant effect on the trust intentions of an individual on the internet (McKnight et al., 2002).

THEORETICAL DEVELOPMENT

The Unified Theory of Acceptance and Use of Technology (UTAUT) is the predominant and most comprehensive technology adoption theory existing in Information Systems (IS) literature to date (Venkatesh et al., 2003; AlAwadhi & Morris (2008). Openness and perceived risk propensity are personality constructs to scrutinize adopters' traits (Costa &McCrae, 1992; Wang et al 2006). Disposition to trust, Institutional based trust and trust beliefs are major constructs of the web trust model that can be used to evaluate peoples trust in web technologies Guo & Barnes 2007;McKnight et al., 2002). ATCUS and v.2.0 can be used to examine people's behaviour towards the computer usage (Popovich et al., 1987; Morris et al., 2009).Furthermore, IT acceptance investigations. The proposed research model for this study can be seen as Figure 1

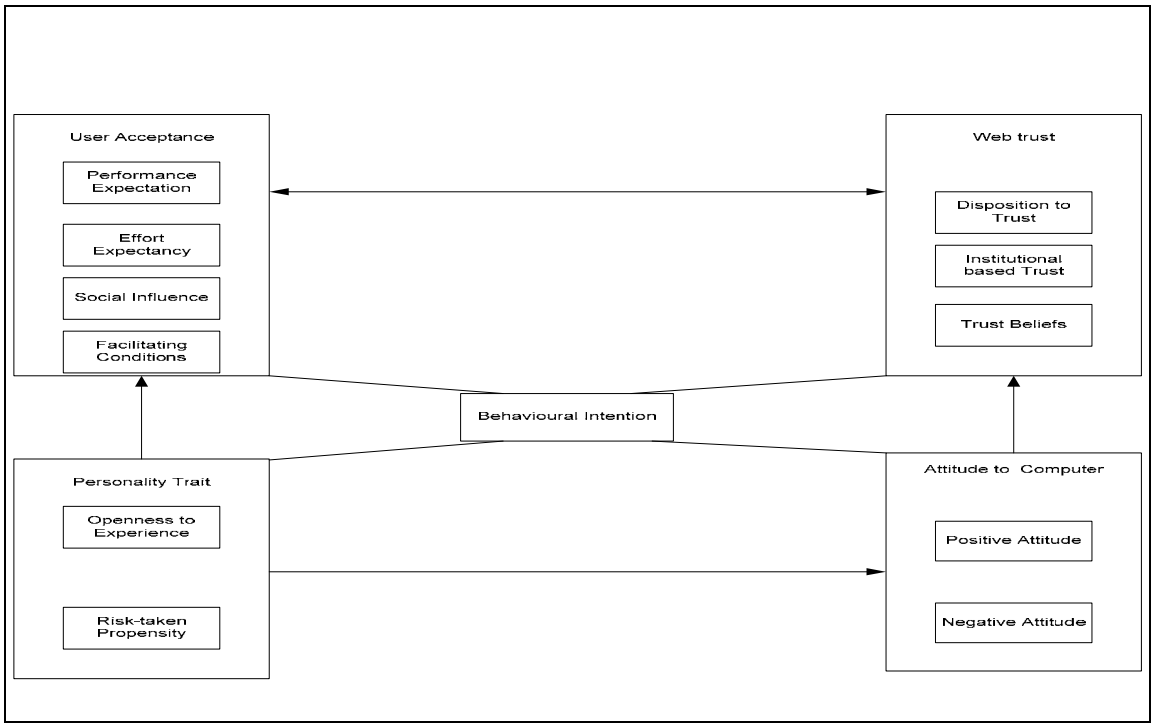


Figure 1. The research model (strait lines imply interrelations for scrutiny)

PREVIOUS RESEARCH

AlAwadhi & Morris (2008) used UTAUT to investigate the adoption of e-government in Kuwait. The study explored factors that determine the adoption of e-government services in Kuwait, a developing country. The authors used an amended version of the UTAUT model to carry out a survey on about 880 students. The empirical data revealed four constructs of UTAUT: performance expectancy, effort expectancy and peer influence, had significant influence on users' behavioural intention to use e-government services. Furthermore, facilitating conditions and behavioural intentions determined students' use of e-government services.

Schaupp et al. (2009) investigated the factors that influence the e-file adoption (a US e-government initiative). This is as a result of the unachieved US congress goal for 80% of tax and informational returns to be filed electronically by 2007. The authors therefore proposed a model of e-file adoption integrating the UTAUT model, online trust, perceived risk, and optimism bias. Using structural equation modelling for analysis, the results showed that performance expectancy, social influence, facilitating conditions, and optimism bias all had significant impact on e-file intention while trust in the internet and trust in e-filer were shown to significantly influence perceived risk.

Several studies have used other acceptance theories to investigate e-government adoption (see Hung et al. 2006; Carter & Belanger, 2008). According to AlAwadhi & Morris (2008) , studies on e-government in the developing countries is limited. Charbaji & Mikdashi (2003) studied 220 students' attitudes towards e-government. The students were from different universities across Lebanon. The constructs applied were cognitive, affective and conative dimensions. The cognitive dimension revealed knowledge and awareness of the people about the service; the affective dimension revealed citizen's feelings towards e-government; and the conative dimension reveals the intention to use e-government services. The study concluded that there is a direct relationship between the cognitive and conative dimensions, while the dimension of affective feelings was found to be less influential.

METHODOLOGY

Quantitative research paradigm shall be considered most suitable for the study (e.g., Straub, 1989; Saunders et al. 2000; Straub et al. 2005).

Survey instrumentation (structured questionnaire) and focus group method were used to collect data. Sale et al. (2002) suggested the use of qualitative research approaches alongside quantitative research paradigm to foster good insight.

Statistical techniques, which include structural equation modelling (SEM) shall be used for the data analysis. Each integrated model will be assessed to investigate the influence on the dependent variable. The software we shall use for the analysis is AMOS 9.0.

EXPECTED OUTCOME

The research model tries to give clear insight of the mental processes that produces individualistic adoption behaviour which could be universal to some degree. The study will discover the determinant factors that are most crucial to adoption behaviour towards e-government services. We anticipate that the model of best fit from this research shall be an extension of the UTAUT. Furthermore, we hope that the model will give a thrust for further e-government research in developing nation.

CONCLUSIONS AND FUTURE WORKS

Finally, an integrative theoretical framework for technology acceptance contained by the ATCUS, trust dimension and personality context was proposed. The empirical validation of the framework shall be presented in coming conferences.

ACKNOWLEDGMENTS

We sincerely appreciate the management of Universiti Technology Petronas for approving and sponsoring this research.

REFERENCES

[1] AlAwadhi, A and Morris,A. "The use of the UTAUT model in the adoption of e-government services in Kuwait", *Proceedings of the 41st Hawaii International Conference on System Sciences, Hawaii, 2008.*

[2] Avgerou, C. "Information systems in developing countries: a critical research review," *Journal of Information Technology* (23:3) 2008, pp 133-146.

[3] Carter, L. and F. Belanger,F. "Citizen adoption of electronic government initiatives," In: *International Conference on System Sciences, Hawaii, 2004.*

[4] Carter, L. and F. Belanger "The Utilization of E-government Services: Citizen Trust, Innovation and Acceptance Factors". *Information Systems Journal, 2005. 15(1): p. 2-25*

[5] Charbaji, A., and Mikdashi, T. "A path analytic study of the attitude towards e-government in Lebanon".*Corporate Governance,(3:1),2003,pp.76-82*

[6] Costa, P. T., Jr., and McCrae, R. R. "Revised NEO personality inventory (NEO PI-R) and NEO five-factor inventory (NEO-FFI) professional manual. Odessa, FL". *Psychological Assessment Resources (1992).*

[7] Dode, R.O. "Prospects of E-Government Implementation in Nigeria,":*in international conference on E-government, December 10-13,2007.*

[8] Guo, Y and Barnes, S. (2007) Why people buy virtual items in the Virtual worlds with real money. The database for advances in Information systems. Vol38, No 4.

[9] Gupta,A., Su,B.,and Walter Z. "Risk profile and consumer shopping behaviour in electronic and traditional channel. *Decision support systems,vol 38,pp347-36, 2004.*

[10] Heeks, R. "e-Government in Africa: Promise and practice," *Journal of information Polity.* Vol7,2002, No2-3. Pp.97-114

[11] Hung, S. Y., Chang, C. M. and Yu. T. J. "Determinants of user acceptance of the e-government services: the case of online tax filing and payment system," *Government Information Quarterly,* (23), 2006, pp.97-122.

[12] Jain, A. "Using the lens of Max Weber's Theory of Bureaucracy to examine E-Government Research," *in-Proceedings at the Human Interaction with Complex Systems (Symposium) 2004*.

[13] Liu,H. "E-government to combat corruption in the Asia Pacific Region," *Proceedings at the IEEE conference 2008.* Retrieved from http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=04680403 on 22/03/2010.

[14] McKnight, D.H., Choudhury, V., and Kacmar, C. " Developing and Validating Trust Measures for E-commerce: An Integrative Typology," *Information System Research*, Vol. 13,2002, No.3, pp. 334-359

[15] Morris, S. A., Gullekson, N. L., Morse, B. J and Popovich P.M. (2009).Updating the attitudes toward computer usage scale using American undergraduate students. Journal Computers in Human Behavior archive, Volume 25 Issue 2, March, 2009

[16] Popovich, Paula M. & Hyde, Karen R. & Zakdajsek, Todd & Blumer, Catherine (1987). The development of the attitudes toward computer Usage scale, Educational and Psychological Measurement, 47, pp.261-269.

[17] Raman, M.,Kaliannan,M., and Yu,C.M "E-business and E-government: Issues and Challenges in Malaysia," *Information Technology Journal* 6(3),2007,428-434.

[18] Sale, J., Lohfeld, L. and Brazil K. "Revisiting the quantitative-qualitative debate: implications for mixed methods research," *Quality & Quantity,* 36(1),2002, 43-53.

[19] Schaupp, L.C., Carter, L and Hobbs, J "E-File Adoption: A Study of U.S. Taxpayers Intentions," *in 42nd Hawaii International Conference on System Sciences – 2009.*

[20] Saunders, M, Lewis, P. & Thornhill, A. Research methods for business students. Essex, the UK: Pearson Education Limited, (2000).

[21] Sitkin,S.B and Pablo, A.L. "Reconceptualising the determinants of risk behaviour," *Academy of management Review,* vol. 17,no.1,1992, pp.9-38

[22] Straub, D. W. "Validating instruments in MIS research," *MIS Quarterly*, 13(2),1989, 147-169.

[23] Straub, D. W., Gefen. D. & Boudreau, M. "Quantitative research". In: D. Avison & J. Pries-Heje (Eds.), *Research in information systems: a handbook for research supervisors and their students.* Amsterdam, Holland: Elsevier, 2005, 221-238.

[24] Venkatesh, V., Morris, M.G., Davis, G.B., and Davis, F.D. "User Acceptance of Information Technology: Toward a Unified View," *MIS Quarterly, Vol. 27, No.3,2003, pp. 425-478.*

[25] Wang, S.,Wand, S., and Wang, M.T. "Shopping online or not?cognition and Personal matters," Journal of theoretical and applied electronic commerce Research.Vol1, No3, 2006, pp68-80.

[26] Warkentin, M. and D. Gefen. "*Encouraging citizen adoption of e-government by building trust,"* Electronic Markets, 2002. 12(3): p. 157-162.

In-Vivo Imaging of the Foveal Thickness in Relation to Degree of Myopia in Malay Subjects

Shah Farez Othman[1, 2, 3,*], Sharanjeet - Kaur Malkeet Singh[2,] Faudziah Abd Manan[2], Ahmad Iskandar Zulkarnain[1], Zainal Mohamad[3] and Azrin E Ariffin[1]

[1]*Faculty of Optometry & Vision Sciences, SEGi University College, No. 9, Jalan Teknologi, Taman Sains Selangor, Kota Damansara, PJU 5, 47810 Petaling Jaya, Selangor, Malaysia*

[2]*Optometry Programme, Faculty of Health Sciences, National University of Malaysia, Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur, Malaysia*

[3]*National Institute of Ophthalmology, Tun Hussein Onn National Eye Hospital (THONEH), Lorong Utara B, 46200 Petaling Jaya, Selangor, Malaysia*

* shahfarez@segi.edu.my

Abstract

This study aimed to determine first, the relationship between foveal thickness and spherical equivalent refraction (SER), and also between foveal thickness and axial length of the eyeball (AL) in Malay subjects. Fifty-nine Malay subjects (age range 19 to 24 years old) with mean SER of -1.91 ± 2.27 D, range +0.50 D to -8.00 D and mean AL of 24.29 ± 1.38 mm were included in this clinical cross-sectional study. Time-domain Optical Coherence Tomography was used to determine the foveal thickness at the macular area. Foveal thickness increased with increasing level of myopia (r = -0.30, p <0.05), and AL (r = 0.45, p <0.05). This study shows that increment in refractive error in the myopic direction is associated with thickening of the fovea. Foveal thickness is also increased with elongation of the globe. Thus, central visual function may be protected in myopic eyes by virtue of this thickening effect at the fovea despite the peripheral stretching of the retina that is expected in such cases.

Keywords

Foveal thickness, Myopia, Optical Coherence Tomography

INTRODUCTION

Retinal changes that occur in highly myopic subjects include peripapillary atrophy, peripheral lattice degeneration, inclined or malinsertion of optic disc, posterior staphyloma, and breaks in the Bruch's membrane.[1, 2] Some highly myopic subjects experience several complications that impair visual acuity purely as a result of increased axial length (AL) or the formation of posterior staphyloma.[2] High myopes also tend to form chorioretinal atrophy at the posterior pole,[2] choroidal neovascularisation at the macular area,[3] and macular hole formation.[4]

The retinal changes in increasing degrees of myopia may be studied with the technique of Optical Coherence Tomography (OCT). OCT has been used to measure the thickness of the retina at the macula area and it was found out that the average thickness of the macula in myopic subjects is not significantly different from emmetropes.[5] The parafoveal region (ie outer macula) however, has been recorded to be thinner, whilst the fovea thicker than emmetropes. [6]

Several studies have looked at changes in retinal structure of individuals with low and moderate myopia regardless of any retinal disease present through clinical observations.[5, 7] A study in Singapore showed that macular thickness in the foveal region was increased in adults with high AL, while the macular thickness at the parafoveal region at superior and inferior quadrants were decreased.[5] OCT studies on two Asian adults groups in Japan and Singapore showed that the average macular retinal thickness did not change with increasing myopia.[5, 7] Mrugacz et al.[8] conducted a study in myopic children in Poland and found that the average macular thickness in fact decreased with increasing myopia.

The purpose of this research was to examine the relationship between the foveal thickness and spherical equivalent error (SER) in myopic Malay subjects. The correlation between axial length of eyeball (AL) with increasing degrees of myopia was also sought.

MATERIALS AND METHODS

One randomly selected eye of consecutively presenting ophthalmically normal 59 Malay subjects was used in the study. The subjects' SER ranged between +0.75 and -8.00 D. The research was conducted at the National Institute of Ophthalmology, Tun Hussein Onn National Eye Hospital (THONEH), Petaling Jaya. Inclusion criteria were based on: best corrected distance visual acuity (BCVA) of 6/6 or better and near acuity of at least N6, intraocular pressure (IOP) of lower than or equal to 22 mmHg. Subjects were free of ocular and systemic pathology with open anterior chamber angles. Exclusion criteria were: history of intraocular or refractive surgery, current treatments that could change the IOP and retinal thickness, astigmatism of more than 1.00 D, and other

neurological diseases. Eyes with any abnormal OCT findings i.e. those with signal strengths < 8 and de-centered images were also excluded. Informed consent was obtained from each subject before enrolment.

All subjects underwent evaluation of BCVA, slit-lamp examination of the anterior segment, tonometry, cycloplegic refraction, fundus photography, A-Scan ultrasound and Stratus OCT 3000 examination.

In the present study Stratus OCT 3000 (Carl Zeiss Meditec, Dublin, CA) was used to measure retinal thickness of the macula (6 mm diameter). The instrument was centered on the foveal pit and the macula was automatically divided to three concentric rings: centre, inner, and outer rings (1, 3, and 6 mm diameter, respectively, see Figure 1).

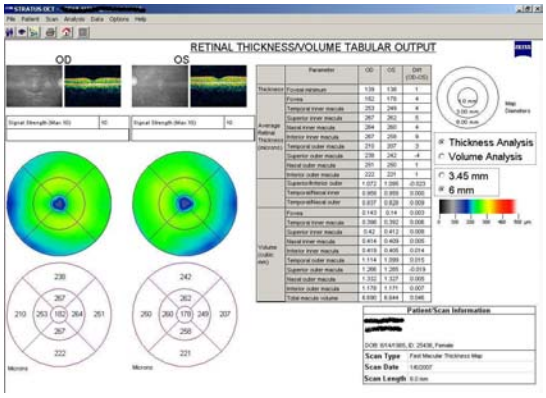


Figure 1. Fast Macular Thickness scan in a Malay myopic subject

In this study, the Fast Macular Scan protocol was used to scan the entire thickness of the retina in the macular area. The scan consisted of 6mm radial line at 6 meridians, which formed patterns of clock hours. Each radial line consisted of 128 A-scan and the total numbers of 768 A-scan patterns were completed in less than 2 seconds. The profile of retinal thickness was taken from each cross-sectional image. The selected cross sectional OCT image was presented with clear overlapping boundaries within and outside of the retina based image processing software.

Retinal thickness profile from the 6 cross-sectional were interpolated using colour scale forming retinal-macula thickness map. All scanning results were automatically analyzed by the Version 4.1 software which also measures the thickness of the retina from the surface of the retina nerve fiber layer to the inner and outer segment junction of retinal pigment epithelium border. Only data from the centre ring which presented the foveal thickness was selected.

Data were analysed using the statistical package SPSS version 14.0 for Windows (SPSS Inc., Chicago, Illinois, USA). A *p* value of less than 0.05 was considered statistically significant.

RESULTS

Fifty nine (59) eyes from 59 Malay subjects (26 males and 33 females) enrolled were available for analysis. The mean age of the subjects was 20.7 ± 1.2 years ranging from 19 to 24 years. The mean SER was -1.91 ± 2.27 D (range: +0.50 D − -8.00 D), and the mean AL was 24.29 ± 1.38 mm (range: 21.88 mm − 30.14 mm). AL was significantly correlated with SER (r = -0.71, p <0.05).

Table 1 shows the correlation results obtained between foveal thickness and the two parameters: AL and SER.

Table 1. Foveal thickness measurement and Pearson correlation between AL and SER results

	Foveal Thickness
Mean ± SD (µm)	184.03±17.42
SER†	r= -0.30
p	0.02*
AL†	r=0.45
p	0.00**

†Pearson correlation test
* Significant correlation between foveal thickness and SER (p <0.05)
** Significant correlation between foveal thickness and AL (p <0.05)

From Table 1, it is noted that negative correlation was found between the thickness of the fovea and SER (r = -0.30, p <0.05), and positive correlation was found between foveal thickness and AL (r = 0.45, p <0.05). The graphical relationship between foveal thickness with SER and AL are shown in the two scatterplots in Figures 2 and 3.

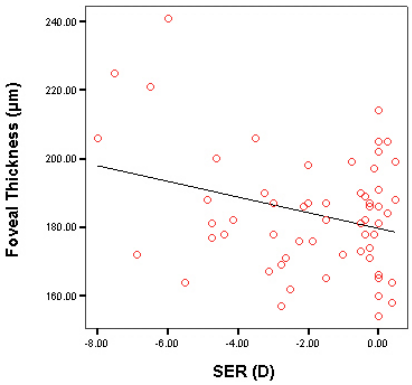


Figure 2. Scatterplot of foveal thickness against SER

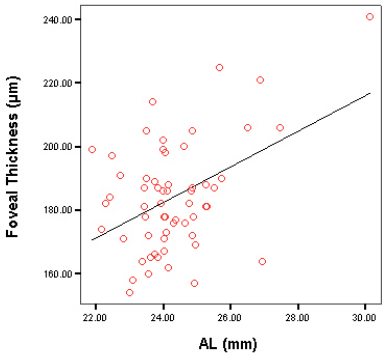


Figure 3. Scatterplot of foveal thickness against AL

DISCUSSION

The present study shows that thickening of the fovea is correlated with increasing myopia and elongation of the eyeball in subjects with SER ranging from +0.75 upto -8.00 D. This is in agreement with the study by Xie et al.[9] that showed correlations between macular parameters and SER and AL in the Chinese. During myopic development axial elongation of the eye can cause mechanical stretching of the posterior pole; this however is more likely to occur in the parafoveal region as it is shown in our results that the central fovea itself experiences thickening. Therefore, peripheral thinning in myopia may serve to preserve the function of the central retina during the axial elongation of the eye.[7] This speculation is supported by findings in animal myopia studies where photoreceptors have been recorded to move towards the central retina from the periphery causing the fovea to be thicker.[10]

CONCLUSION

The present study concludes that increasing level of myopia of up to -8.00D is associated with not just elongation of the eyeball but also thickening of the fovea. Because stretching of the retina in higher degrees of myopia may have deleterious effects on vision, this thickening of the fovea may however, on the contrary have a protective effect on central vision.

ACKNOWLEDGMENTS

We are grateful to Professor Dato' Dr Ramani, Medical Director of THONEH, who consented our use of Stratus OCT, which was the only one available in Malaysia at that time. We also like to thank Mrs Rajmani who taught us how to handle the device, ophthalmic assistants, staff nurses and to the all the subjects for assisting and participating in the study.

REFERENCES

[1] Fan, D.S.P., Lam, D.S.C., Lam, R.F., Lau, J.T.F., Chong, K.S., Cheung, E.Y.Y., Lai, R.Y.K., Chew, S.J. Prevalence, Incidence, and School Progression of Myopia of Children in Hong Kong. *Invest. Ophthalmol. Vis. Sci.*, 45 (2004) 1071-1075.

[2] Curtin, B.J. *The Myopias: Basic Science and Clinical Management*, Harper & Row, Philadelphia, (1985).

[3] Ohno-Matsui, K., Yoshida, T., Futagami, S., Yasuzumi, K., Shimada, N., Kojima, A., Tokoro, T., Mochizuki, M. Patchy Atrophy and Lacquer Cracks Predispose to the Development of Choroidal Neovascularization in Pathological Myopia. *Br. J. Ophthalmol*., 87 (2003) 570-573.

[4] Kobayashi, H., Kobayashi, K., Okinami, S. Macular Holes and Myopic Refraction. *Br. J. Ophthalml.*, 86 (2002) 1269-1273.

[5] Lim, C.C.M., Hoh, S.T., Foster, P.J., Lim, T.H., Chew, S.J., Seah, K.L.S., Aung, T. Use of Optical Coherence Tomography to Assess Variations in Macular Retinal Thickness in Myopia. *Invest. Ophthalmol. Vis. Sci.*, 46 (2005) 974-978.

[6] Othman, S.F., "Ocular Posterior Pole Parameter Measurement in Juvenile-Onset Myopia", MHSc Thesis, National Univer-sity of Malaysia, Bangi, Malaysia (2010).

[7] Wakitani, Y., Sasoh, M., Sugimoto, M., Ito, Y., Ido, M., Uji, Y. Macular Thickness Measurements in Healthy Subjects with Different Axial Lengths Using Optical Coherence Tomography. *Retina*, 23 (2003) 177-182.

[8] Mrugacz, M., Bakunowicz-Lazarczyk, A., Sredzinska-Kita, D. Use of Optical Coherence Tomography in myopia. *J. Ped. Ophthalmol. & Strab.*, 41 (2004) 159-162.

[9] Xie, R., Zhou, X.T., Lu, F., Chen, M., Xue, A., Chen, S., Qu, J. Correlation between Myopia and Major Biometric Parameters of the Eye: A Retrospective Clinical Study. *Optom. Vis. Sc.,*86 (2009) 503-508.

[10] Liang, H., Crewther, D.P., Crewther, S.G., Barila, A.M. A Role for Photoreceptor Outer segments in the Induction of Deprivation Myopia. *Vision Res.* 35 (1995) 1217-25.

Synthesis and Characterization of Methylbenzoylthioureido Derivatives By Spectroscopy Methods

N. Norainun N. Hassan[1]*, Rohayati Roslan[1], Maisarah Kadir[1], M. Sukeri M. Yusof[1] & Desy F.S[2]

[1]Department of Chemical Sciences, Faculty of Science and Technology, Universiti Malaysia Terengganu, 21030 Kuala Terengganu, Terengganu

[2]Institute of Marine Biotechnology, Universiti Malaysia Terengganu, 21030 Kuala Terengganu, Teremgganu

*Corresponding author: nik_norainun@yahoo.com

Abstract

*Three new derivatives of N-methylbenzoylthiouredo derivatives N-(2-methylbenzoylthioureido)-N'-propanoic acid **[I]**, N-(3-methylbenzoylthioureido)-N'-propanoic acid **[III]** and N-(4-methylbenzoylthioureido)-N'-propanoic acid **[IIII]** have been successfully synthesised. All of these compounds were fully characterised using typical spectroscopic techniques, namely ultraviolet-Visible spectroscopy (UV-Vis), Infrared (IR) and ^{1}H and ^{13}C Multi-nuclear Magnetic Resonance (NMR). The IR spectra showed the important bands of interest such as v(O-H), v(N-H), v(C=$O_{carboxylic}$), v(C=O_{amide}), v(C-N) and v(C=S) at 3300-3400 cm^{-1}, 1700 -1720 cm^{-1}, 1650-1680 cm^{-1}, 1300-1400 cm^{-1} and 730-800 cm^{-1}, respectively. In the UV spectra, two chromophores, C=O and C=S have been observed in the compounds which lies at maximum absorption 245 nm and 280 nm, respectively. Chemical shift δ_H(NH) in the compounds can be observed at around δ_H 11 ppm and δ_H(OH) presence at around δ_H 13 ppm in proton NMR. Whilst in ^{13}CNMR, the signal for δ(C=S), δ(C=$O_{carboxylic}$) and δ(C=O_{amide}) can be observed at approximately 180 ppm, 173 ppm and 170 ppm, respectively.*

Keywords

Methylbenzoylthioureido, thiourea, amino acid

INTRODUCTION

The study of thiourea and its derivatives have attracted great deal of interest for researchers since decades ago. It is well known that thiourea and its derivatives have numerous biological properties such as antifungal, antiviral, antitumor agents, as well as inhibitors for nitric oxide (NO) production as potential therapeutic agents [1-4]. Furoylthiourea have been reported that have a great intermediate in agriculture as an herbicide to reduce the growing parasit plant [5]. Thiourea derivatives are able to coordinate with the metal ions. Thiourea molecule contains three potential donor atoms (N and S) that could donate electrons to the metal centre to form a metal complex. Metal complexes of thiourea are also commonly called as semiorganic, include the advantages of both organic and inorganic parts of the complex [6]. In the environmental study, amino-thiourea derivatives act as highly selective reagents for the concentration and separation of metal cation in waste water [7].

MATERIALS AND METHOD

All analytical grade reagents and solvents used were purchased from MERCK and used as received without further purification.

Physical measurements

The UV spectra were recorded by UV-Visible Spectrophotometer Shimadzu model UV-1601PC using methanol as a solvent in 1 cm quartz cell in the sample concentration of 10^{-5} M. The IR spectra were recorded using Perkin Elmer Spectrum 1000 using KBr pellet. The ^{1}H and ^{13}C NMR spectra were obtained with Bruker Avance III 400MHz with the frequency of 400.11 MHz and 100.61 MHz respectively from DMSO-d_6 solutions and referenced against solvent resonances as internal standards.

Preparation of compound I, II and III

2-methylbenzoyl chloride for [**I**]; 3-methylbenzoyl chloride for [**II**]; and 4-methylbenzoyl chloride for [**III**]; (3g, 0.02mol) and ammonium thiocyanate (1.48g, 0.02mol) were put at reflux for *ca.* 1 hour. Then, β-alanine (2.16 g, 0.02mol) was added to the mixture and further underwent reflux and continuously stirring for another *ca.* 5 hours. The mixture was poured into beaker containing ice blocks. The yellowish precipitate obtained in the beaker was then filtered and dried at room temperature. The crude products were recrystallized from suitable solvent to give colourless crystalline solids.

RESULT AND DISCUSSION

In this study, three new compounds were successfully synthesised and characterised spectroscopically, namely *N*-(2-methylbenzoylthioureido)-*N'*-propanoic acid [**I**], *N*-(3-methylbenzoylthioureido)-*N'*-propanoic acid [**II**] and *N*-(4-methylbenzoylthioureido)-*N'*-propanoic acid [**III**], varying its methyl substituent position, *ortho*-, *meta*- and *para*- position at the phenyl ring (**Figure 1**).

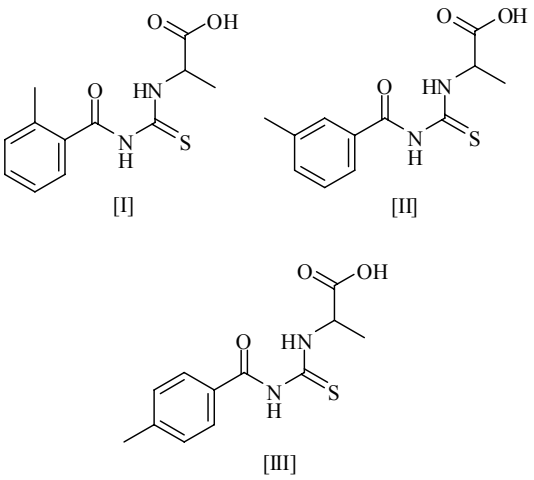


Figure 7. Proposed structure of compounds **I**, **II** and **III**

All compounds exhibit as colourless crystalline solids. These compounds were characterised using UV-Vis, IR and NMR (^{1}H and ^{13}C). The UV spectra show the compounds have two chromophores which are C=S and C=O and presence the maximum absorption at around 280 nm and 245 nm respectively indicating the absorption band possible resulting from n → π* or π→ π* transition.

The IR spectra for all compounds show important stretching of ν(C=S), ν(C=O_{amide}), ν(C=$O_{carboxylic}$), ν(C-N) and ν(N-H) which can be observed at around 700 cm^{-1}, 1200 cm^{-1}, 1700 cm^{-1}, 1600 cm^{-1} and 3000 cm^{-1}, respectively. These data are comparable to the previous reports which were discussing the similar types of derivatives [8-9]. Absorption band for N-H is in the range of 3100-3400 cm^{-1}, which was observed as broad signal due to the intramolecular hydrogen bonding [10] between N-H and C=O [11-12].

These compounds were further characterised using ^{1}H and ^{13}C NMR spectroscopy. The chemical shifts of all compounds were in the agreement with the proposed structures and show no significant difference in chemical shifts for every compound (**Table 1**). ^{13}C NMR spectra for the series of methyl benzoyl thiourea derivatives show
resonance of methyl group which are observed at δ_C 2.60 ppm and 47.16 ppm. The chemical shift for C=S, C=$O_{carboxilic}$ and C=O_{amide} can be observed at around δ_C 181 ppm, δ_C 173 ppm and δ_C 170 ppm.

Protons resonances for OH and CH_3 show as singlet peak, which can be observed at around δ_H 13 ppm, and δ_H 2.39 ppm, respectively. The ^{1}H for (NH)-1 and (NH)-2 can be observed at around 11 ppm, where as for (NH)-1 appears as triplet (J_{HH} = 5Hz) and (NH)-2 presence as singlet peak. The aromatic protons are totally distinguishable from the other resonances in the structures, they exhibit as multiplets due to the overlapping and unresolved protons signals in the aromatic rings which can be observed at around δ_H 7.27-7.90 ppm.

Table 1. Selected spectroscopic data for compounds I, II and III.

Compound	^{1}H NMR/δ	^{13}C NMR/δ	IR/cm^{-1}
I	2.39 (s, 3H, CH_3); 2.66 (t, J_{HH}=6 Hz, 3H, CH_3); 3.82 (q, J_{HH}=6 Hz, 1H,; 7.25-7.44 (m, 4H, Ar); 10.93 (t, J_{HH} = 5 Hz, 1H, NH); 11.50 (s, 1H, NH); 12.45 (s, 1H, OH)	19.85, 32.75, 125.96, 128.39, 131.01, 131.22, 134.64, 136.25, 170.77, 173.41, 180.66	3233.72, 1705.70, 1673.65, 1196.19, 755.92
II	2.37 (s, 3H, CH_3); 2.65 (t, J_{HH}=6 Hz, 3H, CH_3); 3.85 (q, J_{HH}=6 Hz, 1H, CH); 7.38-7.78 (m, 4H, Ar); 11.08 (t, J_{HH} = 5 Hz, 1H, NH-1); 11.26 (s, 1H, NH-2); 12.43 (s, 1H, OH)	21.25, 32.77, 126.15, 128.79, 129.42, 132.56, 134.02, 138.25 168.57, 173.39, 180.73	3369.70, 1715.79, 1671.87, 1392.34, 798.72
III	2.34 (s, 3H, CH_3); 2.73 (t, J_{HH}=6 Hz, 3H, CH_3); 3.46 (q, J_{HH}=6 Hz, 1H, CH); 7.40-7.85 (m, 4H, Ar); 11.14 (t, J_{HH} = 5 Hz, 1H, NH-1); 11.32 (s, 1H, NH-2); 12.57 (s, 1H, OH)	21.58, 47.16, 129.13, 129.47, 129.71, 132.66, 134.32, 138.55 168.35, 170.21, 181.30	3307.34, 1719.30, 1668.24, 1263.34, 760.81

CONCLUSION

A series of amino- thiourea derivatives featuring *N*-benzoyl and β-alanine have been successfully synthesised and fully characterised by using typical spectroscopic methods namely UV, IR and NMR (^{1}H and ^{13}C). There are no significant different in the result although the varieties of substitution of the methyl group at the phenyl ring not at the same position.

ACKNOWLEDGEMENT

This research work was supported by Government of Malaysia under Ministry of Science, Technology and Innovation, Malaysia. (E-sciencefund, vot: 52022) and Universiti Malaysia Terengganu.

REFERENCES

[1] del Campo, R., Criado, J.J., García, E., Hermosa, M.R., Jiménez-Sánchez, A., Manzano, J.L., Monte, E., Rodríguez-Fernández, E. and Sanz, F. (2002). Thiourea derivatives and their nickel(II) and platinum(II) complexes: antifungal activity. Journal of Inorganic Biochemistry. 89: 74-82

[2] Venkatachalam, T.K., Sudbeck, E. and Uckun F.M. (2005). Structural influence on the solid state intermolecular hydrogen bonding of substituted thioureas. Journal of Molecular Structure. 751**:** 41–54

[3] Li, J., Tan, J.-Z., Chen, L.-L., Zhang, J., Shen, X., Mei, C.-L., Fu, L.-L., Lin, L.-P., Ding, J., Xiong, B., Xiong, X.-S., Liu, H., Luo, X.-M. and Jiang, H.-L. (2006). Design, synthesis and antitumor evaluation of a new series of N-substituted-thiourea derivatives. Acta Pharmalogica Sinica. 9: 1259-1271

[4] Kim, Y.J., Ryu, J.-H.,Cheon, Y.-J,.Lim, H.J. and Jeon, R. (2007). Design and synthesis of urea and thiourea derivatives and their inhibitory activities on lipopolysaccharide-induced NO production. Bioorganic & Medical Chemistry Letters. 17: 3317-3321

[5] Xue, S.J., Ke, S.Y., Wei, T.B., & Duan, L.P.,. *Journal of the Chinese Chemical Society*. 2004. **51(5A)**: 1013-1018

[6] Murugan G. Senthil, N. Balamurugan, P. Ramasamy, Mater. Lett. 62 (2008) 3087. Corrigendum to "Growth and characterization of a new metal-organic crystal: Bis-thiourea cobalt chloride (BTCoC)" [Materials Letters, Volume 62, Issues 17-18, 30 June 2008, Pages 3087-3090]

[7] Ankersen, M., Crider, M., Liu, S., Ho, B.,

[8] Andersen, H. S., & Stidsen, C., *J. Am. Chem. Soc.* 1998. **120**, 1368–1373

[9] Yang, W., Zhou, W. and Zhang, Z. (2007). Structural and spectroscopic study on *N*-2-fluorobenzoyl-*N*'-4-methoxyphenyl thiourea. Journal of Molecular Structure. 828: 46–53

[10] Arslan, H., Flörke,U., Külcü, N. and Binzet, G. (2007). The molecular structure and vibrational spectra of 2-chloro-*N*-(diethylcarbamothioyl)benzamide by Hartree–Fock and density functional methods. Spectrochimica Acta Part A. 68: 1347–1355

[11] Tadjarodi, A., Adhami, F., Hanifehpour, Y., Yazdi, M., Moghaddamfard, M. and Kickelbick, G. (2007). Structural characterization of a copper(II) complex containing oxidative cyclization of N-2-(4-picolyl)-N'-(4-methoxyphenyl)thiourea, new ligands of 4-picolylthiourea derivatives and the precursor molecular structure of oxidative cyclization of N-(2-pyridyl)-N'-(4-methoxyphenyl)thiourea Polyhedron. 26: 4609-4618

[12] Yusof, M.S.M., Roslan, R., Kadir, M.A. and Yamin, B.M. (2007). N-[N-(4-Methylbenzoyl)carbamothioyl]glycine Acta Cryst E63: 3591

[13] Ngah, N., Jusoh, A. and Yamin, B.M. (2005). 2-[3-(4-Methoxy benzoyl)thioureido]-3-phenylpropionic acid methanol solvate. Acta Cryst E61: 4307-4309

Horseshoe crab: Carapace to Chitosan and Its Antibacterial Activity

Kamaliah Kasmaruddin[1]*, Zaleha Kassim[1] and Mohd. Effendy Abd. Wahid[2]
[1]Institute of Tropical Aquaculture, Universiti Malaysia Terengganu
[2]Institut of Marine Biotechnology, Universiti Malaysia Terengganu
*k.kamaliah@live.com

Abstract
In this paper, we demonstrate the production of chitosan from the carapace of indigenous marine horseshoe crab, Tachypelus gigas. A traditional chemical deacetylation approach were used and experimented to produce chitosan with various degree of deacetylation. The chitosan produced were then evaluated for ash content, solubility and determined of its degree of deacetylayion using FTIR. Antimicrobial assays were conducted to evaluate the antimicrobial properties of horseshoe crab chitosan.

Keywords
Tachypelus gigas, chitosan, antibacterial activity

INTRODUCTION

Chitosan is a natural biopolymer derived by deacetylation of chitin, a major component of the shells of crustacean such as crab, shrimp, and crawfish. During the past several decades, chitosan has been receiving increased attention for its commercial applications in biomedical, food, and chemical industries (Sandford & Hutchings, 1987).

One of the organisms that possess a high amount of chitin is the horseshoe crab, which the carapace main constituent is chitin. Horseshoe crab are from the arthropods but belongs to the class chelicerata. These primitive animal, like many from its family, bears an outer covering referred as exoskeleton or cuticle mainly functioning as a "skin" to cover its entire body, provides mechanical support, armor against loads from harmful predators and also protecting the inner organs from swelling which is essential since the marine crustaceans are slightly hyperosmotic to seawater (Vernberg and Vernberg, 1983; Horst and Freeman, 1993)

Four species of horseshoe crab existing today, with distribution of geographically determined. To date, numerous publications evolve mainly on indigenous species from the American shores, *Limulus polyphemus*. Established research for different defense molecules using Limulus as animal model are growing fast. However, studies upon *Tachypleus gigas*, the main horseshoe crab species occurred along Indian Bay up to Malay Archipelago are still lacking. Studies on this species is mainly from Inida, uncovering the ecological aspect, diet, parasitology and laso regeneration of tissues. Studies from Japan mainly on innate immunity and defense moluecules such as Factor C, TGase and the coagulation of protein to protect bacterial invasion.

Currently, published data on the transformation of horseshoe crab carapace to chitosan or its potential have not been found, despite its remarkable defense mechanism-of having a innate immunity that enables it to persist its origin till this date. Research on Limulus proves that horseshoe crab carapace contains mainly of chitin-protein base with no crystalline mineral. Since the chitin-protein is a suitable candidate to transform it to its derivative, chitosan, it is possible that horseshoe crab chitosan probably produce higher yield. The innate-immunity and inevitable performance of the defense system of the horseshoe crab, suggest that chitosan from horsechoe crab carapace may have a good potential.

Thus, the direction of this study is to produce chitosan from the horseshoe crab carapace using chemical deacetylation process, determine its characteristics and antibacterial activity.

The typical production of chitosan from crustacean shell generally consists of four basic steps: demineralization (DM), deproteinization (DP), decoloration (DC), and deacetylation (DA) (No & Meyers, 1995). Simplication of chitosan production by elimination of the DC step would considerably reduce production cost due to reduction in chemical usage, process time, and voluminous wastewater discharge.

METHODOLOGY

Raw Material

Samples of horseshoe crab carapace were collected at the bay of Muar, Johor, Malaysia. The horsechoe crab carapace were collected from washed stranded horseshoe carb and brought back to lab for processing.

The carapace were scraped free of loose tissue, washed, dried in vacuum oven to constant weight, and grounded to pass through a 250 μm sieve, then stored in glass container until usage.

Extraction of Chitosan

Chitosan production from carapace of horseshoe crab was executed using standard chemical process;

demineralization(DM), deproteinization (DP) and deacetylation(DA) with modification from Hackman, 1954,and from No and Meyers, 1990.

To test weather alteration of techniques of producing affect the horsehoe crab chitosan quality; experiments were executed with manipulations of concentration of alkaline, presence of heat and duration of treatment for phases. Four different techniques were tabulated according to Table 1.

Table 1. Different treatment prosecuted to horseshoe crab carapace to produce chitosan

	DM	DP	DA
T1	1M HCl 4h, 50°C	1M NaOH 4h, 60°C	50% NaOH, 121°C 15psi for 15 minutes
T2	1M HCl 4h	1M NaOH 4h, 60°C	
T3	1M HCl 2h	5% NaOH 4h, 60°C	
T4	1M HCl 2h, 50°C	5% NaOH 4h, 60°C	

Properties of Horseshoe Crab Chitosan

Ash content

Ash were determined using standard method from AOAC,1990. 3.0 g of resulting chitosan were tared onto a pre-heated, dried in vessicator, pre-weighted crucibles. The samples were place into a preheat muffle furnace 400° C for 4hrs, cooled down and place into vessicators for constant weight before weighing its final weight. Ash were calculated in percentage.

Solubility

Solubility were determined using 1% (v/v) acetic acid dissolved in 1% (w/v) of chitosan powder. The remaining undissolved materials are weight and calculated for percentage of soluble materials.

Agar Diffusion Assay

Prior to antibacterial assay experiment, chitosan powder from horseshoe crab chitosan were dissolved in 1% acetic acid (v/v) with 1% of chitosan (w/v). Incubated in waterbath, shake at 240rpm over night and centrifuged to remove undissolved material. The chitosan solutions were stored in cold room until usage.

An agar well diffusion assay was performed using pathogenic gram positive and gram negative bacterias. The agar well diffusion method (Perez et al., 1990) as adopted earlier (Ahmad and Beg, 2001) was used. Fifty microlitre of diluted inoculum (105 CFU/ml) of test organism was spread on MHA plates. Wells of 8 mm diameter were aseptically cut with sterilized cork borer into the agar medium and filled with 50 µl of chitosan solution of 10 mg/ml to 6.25 mg/ml concentration and solvent blank (1% (v/v) acetic acid) separately. The plates were incubated at 37 °C, overnight. The antibiotic at 50 µg/ml conc. was used in the test system as positive control. Zone of inhibition of bacterial growth around each well was measured in mm.

RESULT AND DISCUSSION

The result shows the percentage yield of chitin and chitosan productions were proximately 44 – 64% and 21-22% (Table 2). The chitosan production from horseshoe crab carapace was higher compared to other studies with different organisms. The solubility and ash content of horseshoe crab chitosan (Table 2), shows a commercial potential of horseshoe crab chitosan for T1. According to Rege and Block (2003), commercial chitosan usually has a solubility varying from 70% to 95%. This concludes that the solubility of horseshoe crabs chitosan is in the commercial standard. According to No *et al*. (1995), which states high quality grade of chitosan should have less than 1% of ash content. Ash measurement is also an indicator of the effectiveness of the demineralization step of removal of calcium carbonate ($CaCO_3$). From the six types of Gram-positive and Gram-negative bacteria tested, all chitosan shows resistant towards *Escherichia*, *Salmonella, Pseudomonas aeroginasa* and *Klebsiella pneumonia* (Table 3). This is consistent with finding by Fernandez et al., 2006; chitosan were reported as effective antibacterial and antifungi properties against *Escherichia coli, Pseudomonas aeruginosa* and *Salmonella parathypi*. The data of horseshoe crab production shows T1 as the optimum procedure in terms of production, ash content and also solubility. All of the chitosan shows antibacterial activity against pathogenic bacterias despite their different production. Study on the potential of horseshoe crab chitosan in tissue proliferation is needed to validate the potential of horseshoe crab chitosan, as well as the molecular weight and degree of deacetylation to provide better details of the quality of the horseshoe crab chitosan.

Table 1. Yield of chitosan according to different treatment, resulting ash content and solubility in 1% acetic acid.

Table 2. Yield of chitosan, ash content and solubility of chitosan produced.

Sample	Chitosan Yield (%)	Ash (%)	Solubility (%)
T1	21.8865 ± 3.67	8.3471 ± 1.1666	92.08704
T2	20.8052 ± 0.33	37.8289 ± 5.4962	59.03733
T3	21.1159 ± 3.45	9.3470 ± 3.6072	82.30088
T4	21.6782 ± 1.29	23.1014 ± 8.5552	82.34127

Table 3. Minimum inhibition concentration for agar diffusion assay of different horseshoe crab chitosan

Bacteria	T1	T3	T4
Gram-positive bacteria			
Staphylococcus aureus	-	-	-
Streptococcus aureus	6.25 $\mu g m^{-1}$	100 $\mu g m^{-1}$	6.25 $\mu g m^{-1}$
Bacillus sereus	-	6.25 $\mu g m^{-1}$	75 $\mu g m^{-1}$
Bacillus aureus	-	12.5 $\mu g m^{-1}$	100 $\mu g m^{-1}$
Gram-negative bacteria			
Salmonella sp	100 $\mu g m^{-1}$	100 $\mu g m^{-1}$	50 $\mu g m^{-1}$
Escherichia coli	-	50 $\mu g m^{-1}$	-
Pseudomonas aeruginosa	-	-	-
Klebsiella pneumonia	-	-	-

Determining the Time of Second Polar Body Extrusion from The Fertilized Eggs of Red Hybrid Tilapia (*Oreochromis Mossambicus* X *Oreochromis Niloticus*) During Triploidy Induction

Pradeep, P.J.[1*], Srijaya, T.C.[1], Shahreza, M.S[2], Mithun S[1], Anuar H[1] and Anil, C.[1]
[1]Institute of Tropical Aquaculture
[2]Faculty of Agrotechnology and Food Science,
University Malaysia Terengganu,Malaysia
[*] Corresponding author; email: legendofmortals@yahoo.com

Abstract
The red hybrid tilapia has been widely produced for human consumption all around the world and as such received much market demand in the recent years. An attempt therefore, was made to achieve greater knowledge of its biology, improvement in its production including the growth and food conversion efficiency which are usually compensated by the precocious sexual maturation, interfering with somatic growth. The possible use of sterile triploid red hybrid tilapia is an interesting option for its culture due to their proliferating breeding activities. The aim of present study was to investigate and optimized the time of extrusion of second polar body from the newly fertilized eggs of red hybrid tilapia during heat shock treatment to produce a high number of triploid individual. We have demonstrated successfully that application of heat shock treatment of 41° C for 3.5 minutes duration and after 2, 3, 4, 4.3, 5 and 6 min of fertilization showed that the second polar body release was at 4 min of fertilization where a survival rate of 67.0% and percentage of triploid fish 89.7% was observed.

INTRODUCTION

The interest in triploids arises from the fact that they are sterile and have been widely applied to a variety of fishes in recent years [1**]**. The sterility offered by triploids has been known to benefit the fishes by protecting their somatic growth, survival and flesh quality from the distrustful effects of sexual maturation **[**2]. Nevertheless, sterile triploid tilapias have been suggested as the possible solution for negotiating the problem of precocious sexual maturity and unwanted reproduction in culture [3]. Triploidy induction in tilapia has been induced by suppressing the second meiotic division or by preventing the escape of second polar body from the recently fertilized eggs by applying various shock treatments like temperature, pressure or chemicals [2, 4]. Another method for producing triploidy in tilapia is by crossing the tetraploid individual with a normal diploid individual [5]. Though 100% triploidy has been reported in several species of tilapia, however, the results were not always consistent. The question remains as to the suitable time after fertilization or the time where the second polar expels out from each species for triploidy induction. This timing is critically important for the success of induction and since this factor is species specific, the optimization of this parameter seems to be essential. Hence an attempt has been made to determine the exact time where the second polar body extrudes out from the newly fertilized eggs of red hybrid tilapia (*Oreochromis mossambicus* X *Oreochromis niloticus*) for maximizing the triploid production in this species.

MATERIALS AND METHODS

In order to find out the time after fertilization (TAF) where the second polar body expels out from the recently fertilized eggs of red hybrid tilapia, the optimized values of heat shock in Nile tilapia, *O. niloticus* from the published work of [7] was taken and as such a temperature of 41^0 C and a duration shock of 3.5 minute were kept constant for this experiment. The time at which all shock treatments used were; 2, 3, 4, 4.5, 5 and 6 minutes to find out the appropriate timing for preventing extrusion of second polar body from the egg. In control group, no shock treatment was given and the fertilization was done at 28^0 C. For TAF study, a total of 4 females and 12 males ranging in size from 200-250 g were used and each female was considered as a replicate. Results of the three replicates were assured by conducting a confirmatory experiment using one more female.

Evaluation Of Time After Fertilization For Different Treatments

For each experiment, eggs from only one female and concentrated sperms from 3 males (0.6-1 ml) were used. Prior commencing the experiment, eggs were collected in the petri dishes. Previously collected sperms were then spread over eggs. Immediately after this, 20 ml of fresh water (28 ± 1^0 C) was directly added to initiate activation of sperms. The time of adding of water was considered as the time of fertilization (t_o). The petri dish was gently shaken for thorough mixing of sperms with eggs. The eggs were then left undisturbed for proper fertilization before initiation of different treatments. After a time gap of 1 minute and 30 seconds, the fertilized eggs from the petri dishes was siphoned using a small plastic pipette

and eggs were distributed to different plastic strainers assigned for respective treatments. These strainers were kept inside a plastic tub containing water with temperatures 28±1^{o} C. The eggs (100-300 numbers) were placed in each strainer where five strainers were designated for the heat shock treatment and one strainer for control group. The heat shock was applied to fertilized eggs by transferring the strainers to a temperature controlled water bath (45 l) where a temperature 41^{o} C was maintained and the eggs were retained for 2, 3, 4, 5 and 6 minutes after fertilization (t_0). The control group was maintained at 28^{0} C in the same tray without giving any shock treatment. The treated and untreated eggs after counting were identically incubated in round-bottom glass jars (250 ml) connected to a re-circulatory incubation system. Fertilized eggs were counted at the blastula stage,10 hrs after fertilization (a.f.), hatching rate at 80-90 hrs (a.f.) and survival rate on fifth day (120 hrs a.f.). Triploidy induced in each shock given treatments was identified using well spread metaphase chromosomes prepared from one to two day old larvae (20-30 larvae) and percentage of the triploidy was enumerated. A confirmatory experiment was also done after the previous 3 trials experiments.

RESULTS

Results of the present experiment revealed that a TAF of 4 minute at 41^{0} C of temperature shock for 3.5 minute duration yielded a maximum percentage of triploid individuals by 89.7% (Table 1). This treatment timing gave relatively reasonable survival of 67.0% with a maximum triploid yield of 69.8%. The appropriate time to prevent the extrusion of second polar body for inhibiting the second meiotic division was thus at 4 minute in red hybrid tilapia. Heat shock initiated at 2, 3, 4, 5 and 6 minutes after the fertilization showed hatching below 50% at 2 and 3 minutes after the fertilization. However, hatching percentage was relatively higher at TAF 4, 5 and 6 with 62.7, 66.9 and 69.8%; respectively. It was observed that when the initiation of shock timing was increased, the hatching percentage also increased considerably. An increasing trend in survival of larvae was observed when the shock timing was increased from 2 minute to 6 minute. Maximum survival was observed at TAF 6 minutes (72.7%) whereas TAF 2 minutes resulted in only 54.5% survival of larvae. The treatment which gave maximum triploid percentage *i.e.* TAF 4 minute showed a survival of 67%. All treatments were showing triploid percentage more than 30%. At TAF 2, 3 and 4 minutes, the heat shock application showed an increasing trend of triploid rate. The shocks initiated after 4 minutes showed a decreasing trend in triploid rate where TAF 5 minutes gave 62.9% followed by 6 minute showing only 37.2%. The confirmatory trial experiment done using a single female showed a similar result where TAF 4 minute showed the maximum triploid percentage of 88% (Table 2).

DISCUSSION

Triploidy induction could be made possible within a wide range of zygotic ages (0-15 minutes) using varied induction methods in different species of tilapia [8]. TAF varying between 0.5 and 9 minutes by cold shock treatment (7-11^{0} C) of duration between 30 and 60 minutes, 3 and 5 minutes of post fertilization by heat shock (39.5– 42^{0} C) for durations 3 to 4.5 minutes and 2.5 to 9 minutes after fertilization by pressure shock (7500- 9000 psi) for 2-7 minutes duration have been successfully applied for triploidy induction in all the three commercially important species of tilapia [3]. In Nile tilapia [7] found that for achieving 100% triploidy induction using pressure shock treatment, a longer initiation time of 9 minute was required whereas for cold shock the initiation time was reduced to 7 minutes and the least was for heat shock at 5 minutes. The present study also supports the [7] findings as the best result was shown at 4 minute after the fertilization. In the present study, the percentage of triploidy increased gradually from 54.4% during 2 minute after fertilization to 89.7% at 4 minutes and then started decreasing and reached to 37.2% at 6 minutes. [8] in their experiment for determining the zygotic stages for triploidy induction in *O. aureus* also showed almost similar pattern. In this experiment, triploid percentage showed about 93% at one minute followed by maximum 100% at 3 minutes and then decreasing to 80% while inducing at 5 minutes. It was evident from the studies of [8] that second polar body was completely released out within 7 minutes after the fertilization.

The results of the study by [7] at a temperature of 41^{0} C with 3.5 minutes duration showed almost similar values as obtained in red tilapia. At this standard conditions the percent survival, relative to control under various time after fertilizations of 2, 3, 4, 5 and 6 minutes, showed an increasing pattern with 60, 60.7, 69.6, 82.1 and 85.7% respectively in experiments conducted by [7], whereas it was 63.4, 70.9, 77.9, 80.3 and 84.7% respectively in the present study. Although a similar pattern in triploid percentage as compared to the present research was reported by [7] but the maximum triploid individuals were seen at 5 minute of initiated shock treatment compared to shocks initiated on other time after fertilization trials. However, in the present research maximum triploid rate was observed at 4 minute post fertilization. [7] further reported that the time of the second meiotic division in Nile tilapia was varying in a wide range from 2-15 minutes after fertilization under various shock inducing agents with altered durations. However, the meiotic spindle apparatus was disturbed effectively in a very narrow window of time in all the three induction protocols applied.

Hence it was proved from the study of [7] any variation from the optimized value of TAF affected considerably either their survival or triploidy yield. [9] achieved 100% triploidy in *O. mossambicus* at a temperature of 42^0 C with time after fertilization of 2.5 minutes for 3 minute duration. [7] also obtained 100% triploidy in *O. niloticus* when a TAF of 5 minute for 3.5 minutes duration at a temperature of 41^0 C was applied. However, compared to both the parent species, the red hybrid tilapia showed that the TAF was falling between the timings of both parent species where 4 minute duration proved to be the best timing for inhibiting the second polar body. [10] also showed that for retaining the second polar body in newly fertilized eggs of Nile tilapia, a temperature shock of 41^0 C for 4 minutes of initiation time for duration of 4.5 minutes was also effective for producing 100% triploidy. [11] suggested that triploidy induction by heat shock could be possible only within a narrow range of zygotic ages of 2.5–3.5 and 3.5–4.5 minutes for *O. aureus* and *O. niloticus*, respectively. Indeed, a wider range of zygotic ages between 0 and 15 minute was possible with cold shock treatment in *O. niloticus* and *O. aureus*. In another attempt by [12], TAF 3 minute was found to produce 100% triploid fish when applied for 3.5 - 4 minutes duration in *O. aureus*.

ACKNOWLEDGMENT

The authors are grateful to the director, of Institute of tropical aquaculture for providing laboratory and hatchery facilities. The authors (PPJ, STC & MS) are also thankful to University Malaysia Terengganu for the award of research assistantships whereas (AC) for the award of a Principal Research Fellowship.

REFERENCE

[1] Piferrer, F., Beaumont, A., Falguiere, J.C., Flajshans, M., Haffray, P., Colombo, L. 2009. Polyploid fish and shellfish: production, biology and applications to aquaculture for performance improvement and genetic containment. *Aquaculture* 293: 125–156.

[2] Maxime, V. 2008. The physiology of triploid fish: current knowledge and comparisons with diploid fish. *Fish and Fisheries* 9: 67–78.

[3] Mair, G.C., 1993. Chromosome-set manipulation in tilapia techniques, problems and prospects. *Aquaculture,* 111: *227-244.*

[4] Tiwary, B.K.; Kirubagaran, R. and Ray, A.K. 2004. The biology of triploid fish. *Reviews in Fish Biology and Fisheries*, 14: 391–402

[5] Maxime, V. 2008. The physiology of triploid fish: current knowledge and comparisons with diploid fish. *Fish and Fisheries* 9: 67–78.

[6] Hussain, M.G. 1996. Advancement in Chromosome Engineering Research in Fish: Review of Methods, Achievements and Applications. *Asian fisheries science*, 9: 45-60.

[7] Hussain, M.G., Chatterji, A., MeAndrew B.J. and Johnstone, R. 1991. Triploidy induction in Nile tilapia, *Oreochromis niloticus* L. using pressure, heat and cold shocks. *Theoretical and Applied Genetics* 81: 6-12.

[8] Chang, S.L. and Liao, I.C. 1996. Triploidy Induced by heat shock in *Oreochromis aureus*, In: Pullin,R.S.V., Lazard, J., Legendre, M., Amon Kothias, J.B. and Pauly, D. (eds.). The Third International Symposium on Tilapia in Aquaculture. ICLARM Conf.Proc. 41.Pp: 273-279.

[9] Pandian, T.J. and Varadaraj, K. 1988. Techniques for producing all male and all triploid *Oreochromis mossambicus*, P. 243-249. In R.S.V. Pullin, T. Bhukeswaran, K. Tonguthai and J.L. Maclean (eds). The Second International Symposium on Tilapia in Aquaculture, ICLARM Conference Proceedings 15, 623p. Departmenat of Fisheries, Bangkok, Thainland and International Centre for Living Aquatic resources Management, Manila, Philippines.

[10] Puckhaber, B. and Schwark, G.H. 1996. Growth and gonadal development of triploid tilapia (*Oreochromis niloticus*).Pp: 377-382. In Pullin,R.S.V., Lazard, J., Legendre, M., Kothias, J.B.A. and Pauly, D. (eds). The Third International Symposium on Tilapia in Aquaculture. ICLARM. Conf. Proc. 41, Pp: 575.

[11] Don, J. and Avtalion, R.R. 1988. Comparative study on the induction of triploidy in tilapias, using cold and heat-shock techniques. Journal of fish biology 32: 665-672.

[12] Don, J. and Avtalion, R.R. 1986. The induction of tiploidy in *Oreochromis aureus* by heat shock. *Theoretical and applied genetics*.72: 186-192.

Co-authors email;
Srijaya, T.C.: sreejayamol@yahoo.com
Shahreza, M.S.: shahreza@umt.edu.my
Mithun, S.: mithunsugun@gmail.com
Anuar, H.: anuar@umt.edu.my
Anil, K.C.: anilch_18@yahoo.com

Table 1: Assessment of time after fertilization (TAF) to get the maximum triploid percentage

Groups	Hatching rate (%)	Survival rate (%)	Percentage of survival in relation to control (%)	Triploid rate (%)	Triploid yield (%)
2*	36.0±2.1	54.5±4.2	63.4±2.7	54.4±2.0	34.4±0.6
3*	48.7±3.7	60.9±1.6	70.9±0.6	73.6±1.5	52.2±0.9
4*	62.7±5.7	67.0±4.1	77.9±2.2	89.7±2.5	69.8±0.5
5*	66.9±4.0	69.0±2.6	80.3±2.6	62.9±2.7	50.5±3.5
6*	69.8±1.9	72.7±1.4	84.7±2.3	37.2±2.1	31.5±2.1
Control	77.9±2.8	85.8±3.0	100	0	0

(Standard deviation)
* Time after fertilization (in minutes)

Table 2: Conformation trial for time after fertilization (TAF) to get maximum triploid percentage

Groups	Hatching rate (%)	Survival rate (%)	Percentage of survival in relation to control (%)	Triploid rate (%)	Triploid yield (%)
4*	64.2	70.1	82.7	88	72.8
4.3*	72.4±3.5	73.3±1.3	86.5±1.6	70.8	61.2±1.2
5*	74.1	71.1	83.9	62.5	52.4
Control	88.6	84.7	100	0	0

± (Standard deviation)
* Time after fertilization (in minute)

Optimizing Subtractive Clustering parameters for Fuzzy rules generation in Pattern Classification

Chawalsak Phetchanchai[1,*], Mansur Omar Mansur[2], Ali Selamat[3] and Abdul Hanan Abdullah[3]
[1]Suan Dusit Rajabhat University, Bangkok, Thailand
[2]Sirt University, Sirt, Libya
[3] Faculty of Computer Science & Info.Sys., Universiti Teknologi Malaysia, Johor, Malaysia
*chawalsak_phe@dusit.ac.th

Abstract
In fuzzy pattern classification, a training dataset requires a data partitioning method to divide data into smaller groups and the fuzzy rules are generated based on these subgroups. Subtractive Clustering method is widely used to partition data since it provides automatically partitioning data into clusters, but however, the difficulty of using Subtractive Clustering method is the predefined parameters such as data radii and squash factor which affect the number of clusters to be generated. In this paper, we propose the method to optimize these Subtractive Clustering parameters by using Particle Swarm Optimization method. The experiments perform on some UCI standard datasets.

Keywords
Fuzzy pattern classification, ANFIS, Particle Swarm, Optimization, Subtractive Clustering

Development of *Agrobacterium*-Mediated Transformation Method For Marine Microalgae (*Chlorella* sp. and *Nannochloropsis* sp.)

Willy Yee [1], Ahmad Aziz[1] and Thye San Cha[1*]
[1]Department of Biological Sciences, Faculty of Science and Technology, Universiti Malaysia Terengganu, 21030, Kuala Terengganu, Malaysia.
*cha_ts@umt.edu.my

Abstract

We report here for the first time the establishment of an Agrobacterium tumefaciens transformation method for the marine microalgae Chlorella sp. and Nannochloropsis sp. Using the binary vector pCAMBIA1304 harboring the gus-gfp reporter and a hygromycin phosphotransferase selectable marker. Parameters known to influence the efficacy of Agrobacterium T-DNA transfer which were pre- culture, inoculum density, co-cultivation temperature, co-cultivation duration, pH of co-cultivation medium and the concentration of acetosyringone were evaluated in this study by monitoring transient gus expression two days post-infection. The optimized parameters for Chlorella and Nannochloropsis were obtained and the combined optimized parameters resulted in an average transient transformation frequency of 25% for both microalgae. The transgenic nature of transformants was confirmed by polymerase chain reaction with the uidA and hpt specific primers. The developed transformation method will enable manipulation of important biochemical pathways and facilitate the genetic improvement of these commercially important microalgae

Keywords
Agrobacterium, *gus*, *Nannochloropsis*, *Chlorella*, Genetic transformarion

Removal of Oil and Grease as Emerging Pollutants of Concern (EPC) in Wastewater Stream

Alade Abass Olenrewaju
Universiti Islam Antarabangsa, Malaysia
abasslad@yahoo.com

In Vitro Anticancer And Antioxidant Activities Of Malaysian Sea Cucumber

Osama Y Althunibat
Universiti Islam Antarabangsa, Malaysia
Thnibatjust2001@yahoo.com

Stimulation of Ovarian Maturation in Blue Swimming Crab, Portunus Pelagicus (Linnaeus, 1758) by Eyestalk Ablation and The Identification of A Reproductive Hormone, Methyl Farnesoate

Wan Nurul Nadiah Binti Wan Rasdi
Universiti Malaysia Terengganu
dyaleto@yahoo.com

Preliminary Study on Bio-ethanol Production from the Fermentation of Palm Oil Trunks Sap

Norhazimah Abdul Halim, Che Ku M. Faizal and Jailani Salihon
Faculty of Chemical and Natural Resources Engineering, Universiti Malaysia Pahang, Lebuhraya Tun Abdul Razak, 26300 Gambang, Pahang, Malaysia
aimc_86@yahoo.com

Abstract
Palm oil trunk is a waste generated from the re-plantation of palm oil trees at every 20-25 years interval. Palm oil trunks sap contains lot of sugar and can be directly fermented to fermentation products. The aims of this preliminary study was to investigate the production of bio-ethanol using different strains of Saccharomyces cerevisiae and also to know the effect of different pretreatment on sap to the bio-ethanol production. The fermentation process using Saccharomyces cerevisiae Kyokai.7 and baker's yeast Saccharomyces cerevisiae were performed in heat sterilized and non-sterilized sap. Results showed that Saccharomyces cerevisiae Kyokai.7 produced more ethanol compared to the baker's yeast Saccharomyces cerevisiae. It was also confirmed that non-sterilized sap contains microorganisms that competed with Saccharomyces cerevisiae Kyokai.7 thus lowered the ethanol productivity.

Keyword
Sap; bio-ethanol; Saccharomyces cerevisiae

INTRODUCTION

Recently, continuous alert for the serious shortage of fossil resource and increased concern for the negative impact of fossil fuel on the environment has put great pressure on society to find renewable fuel alternatives (Hahn-Hagerdal *et al.* 2006). In general, natural resources that contain bioenergy and can be processed to obtain more complex energy carriers suitable for end-uses are called biomass (BNDES and CGEE, 2008). Examples of sources of bioenergy include wood and sawmill waste, char-coal, biogas resulting from the anaerobic decomposition of waste, as well as liquid biofuels, such as bioethanol and biodiesel generated from the burning of fuels such as bagasse and wood (BNDES and CGEE, 2008). Ethanol is the example of renewable energy and can be derived from lot of sources. Ethanol can be used as an automotive fuel by itself and can be blend with petrol to form an ethanol/petrol blend (Trummer, 2006).

The palm oil originated from West Africa and was introduced by the British in the early 1870s to Malaysia, then Malaya, as an ornamental plant (Malaysian Palm Oil Council, 2007). In 2007, Malaysia generated about 113.3 million tonnes (MT) of palm oil biomass (Rashid and Ibrahim, 2009). From this figure, 66.4 MT was frond, empty fruit bunch (EFB), 18.0 MT and trunks, 12.9 MT. Trunks are easy to be degraded compared to EFB and fronds because it's contained more cellulose and have lower lignin percentage. Most of palm oil trunk is converted into various types of wood such as saw-wood and ply-wood or lumber (Sumathi *et al.,* 2008). The outer part of palm oil trunks is removed to be used for furniture industries. Palm oil trunk cannot be used as building structure due to its low specific density.

MATERIALS AND METHODS

Microorganism and medium

The strain used for bio-ethanol production was sake brewing strain, *Saccharomyces cerevisiae* Kyokai.7 (ATCC 26422) obtained from American Type Culture Collection and baker's yeast *Saccharomyces cerevisiae* obtained from Mauri Sdn Bhd. The strains were maintained at 4^{o}C and sub-cultured every month on YPD medium agar (g/L): glucose (dextrose) 10, peptone 5, yeast extracts 5, agar 20.

The palm oil trunks were freshly obtained from Jerantut Plantation, Pahang, Malaysia. The sap was collected by pressing middle of trunks with press machine and kept at -20 ^{o}C in freezer. All the sap was filtered with 9.0 μm filter before use.

Inoculums preparation

Stock cultures were prepared by transferring *S. cerevisiae* Kyokai.7 or baker's yeast *S. cerevisiae* into 500 mL Erlenmeyer flask containing 250 mL of medium (glucose 10 g/L, peptone 5 g/L, yeast extracts 5 g/L). Strain was incubated for 12- 18 hours at 30 ^{o}C and 150 rpm until reached standard initial concentration. The cell concentration was standardized to 0.44-0.46 g/L.

Different Strains Fermentation

After the initial both strains have been standardized, 10% v/v of inoculums was transferred into a 500 ml Erlenmeyer flask with 250 ml total working volume. Fermentation of sap was run for 48 hours. Samples were collected and analyzed at 0, 24, 36 and 48 hours.

Different Sap Pretreatment

Sterilized medium was prepared by autoclaving sap at 121^{o}C for 15 minutes before use. For non-sterilized medium, sap was directly used after filtration with 9.0 μm filter. Small amount of non-sterilized sap was

streaked on sterile agar plate to detect any existence of other organisms within sap.

Fermentations were carried out by transferring 10% v/v of *S. cerevisiae* Kyokai.7 in a 500 ml Erlenmeyer flask with 250 ml total working volume. Fermentation samples were collected and analyzed at 0, 24, 36 and 48 h.

Analysis

The fermentation broth was centrifuged at 10,000 rpm for 5 minutes to separate supernatant. The supernatant was then removed and stored at -20°C for ethanol and sugar analysis. Pellet were rinsed twice and then dissolved into distilled water and read at 600 nm (UV-Vis spectrophotometer). Distilled water was used as blank. Absorbance values were converted into biomass concentration by using standard curve obtained from absorbance versus cell dry weight calibration y = 10.582x - 0.0058, where Y is biomass (g-dry biomass/L) and X is absorbance at 600 nm. For cell dry weight determination, pellets were dried at 60°C until constant weight after rinsed twice with distilled water.

Ethanol concentrations were determined by a gas chromatograph (HP Agilent) equipped with a flame ionization detector (FID) and Innowax column (30 m x 12 mm ID x 2 µm film thickness). Temperature of injector and detector were 150 °C and 200 °C, respectively. The carrier gas was nitrogen at a flow rate of 15 m

Total reducing sugars were determined by DNS method by read absorbance at 540 nm and validated by Biochemistry Analyzer YSI 2700.

Bio-ethanol fermentation performance was evaluated based on last ethanol concentration achieved since initial concentrations of sugar have been fixed.

RESULT AND DISCUSSION

Fermentation Profile

The total initial glucose concentration in the sap was 13.5- 22.4 g/L. Preliminary High Performance Liquid Chromatography (HPLC) analysis on sap showed that sap sometimes contained modest amount of sucrose and fructose. From graph, it was observed that glucose was thoroughly nearly consumed after 48 hour. This was shown by Figure 1.

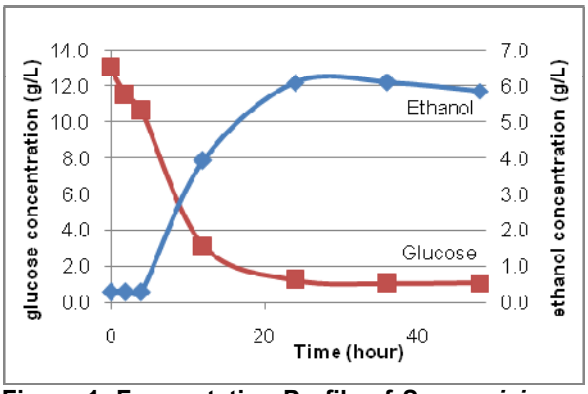


Figure 1: Fermentation Profile of *S. cerevisiae* Kyokai.7 in 48 hours. Blue line represents ethanol concentration during fermentation. Red line represents glucose concentration during fermentation.

Comparison on Different Strains

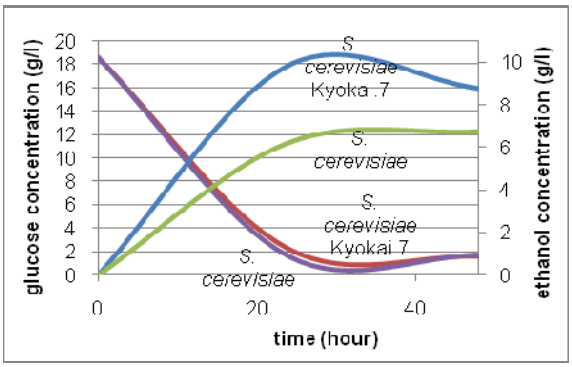
Both strain performances were compared based on maximum ethanol concentration and percentage yields obtained. Table 1 summarized the fermentation data for both strain in the sap.

Table 1: Summarized data of different strain for bio-ethanol production from fermentation of palm oil trunks sap

Parameter	*S. cerevisiae* Kyokai.7	Baker's yeast *S. cerevisiae*
Maximum biomass (g/L)	1.252	1.055
Maximum ethanol (g/L)	8.763	6.780
Glucose consumption (g/L(h^{-1}))	0.355	0.353
Growth rate (g/L(h^{-1}))	0.026	0.022
Yield $_{P/S}$ (g ethanol/(0.511*g glucose)$^{-1}$)	0.919	0.710

It was clearly shown in Figure 2 that *S. cerevisiae* Kyokai.7 able to produce more ethanol compared to baker's yeast *S. cerevisiae.* This might due to the ability of *S. cerevisiae* Kyokai.7 to consume others substrate beside glucose.

Figure 2: Fermentation Profile of *S. cerevisiae* Kyokai.7 and baker's yeast *S. cerevisiae* in 48 hours. Blue line and green line represent ethanol concentration during fermentation for *S. cerevisiae* Kyokai.7 and baker's yeast *S. cerevisiae* respectively. Red line and purple line represent glucose concentration during fermentation for *S. cerevisiae* Kyokai.7 and baker's yeast *S. cerevisiae* respectively.



This agreed with Pereira *et al*. (2010) works that showed industrial strains are able to produce more ethanol compared to laboratory strains (19.2% v/v and 17.5% v/v respectively). Pereira *et al.* (2010) evaluated and compared the performance of laboratory and industrial strains under very high gravity (VHG) batch fermentation conditions to select highest productivity strains and ethanol titre.

Kun (Ed) (2003) stated that the yeast commonly used in industrial alcohol production include *Saccharomyces cerevisiae* (ferment glucose, fructose, maltose, maltoriose), *S. uvarum* (carlbergensis), *S. diatataticus* (ferment dextrins), *Kluyveromycesfragilis* and *K. lactus* (ferment lactose).

Comparison on Different Pretreatment

Figure 3 showed the outcome of *S. cerevisiae* Kyokai.7 fermentation in heat sterilized and non-sterilized sap.

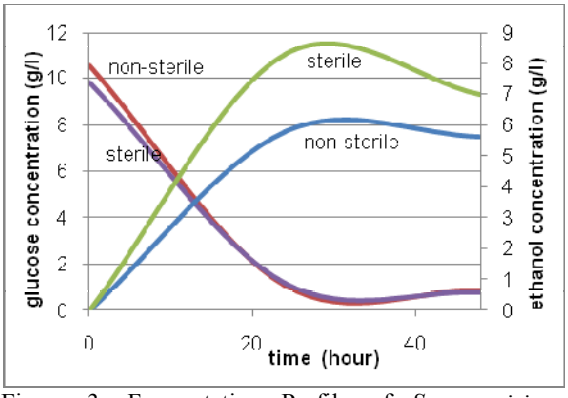


Figure 3: Fermentation Profile of *S. cerevisiae* Kyokai.7 in 48 hours. Green line and blue line represent ethanol concentration in sterile and non-sterile sap respectively. Red line and purple line represent glucose concentration in sterile and non-sterile sap respectively.

From pre-streaked test, we observed growth of contaminant inside non-sterilized sap. This can explained the reason of low ethanol production in non-sterilized sap. Other microbes might use substrate in the sap to produce other product alongside ethanol. Based on economical view, it is somewhat important to pretreated sap rather than obtained low ethanol. Further screening should be done to know the types of microbes that competed with *S. cerevisiae* in non-sterilized sap.

CONCLUSION

S. cerevisiae Kyokai.7 have better fermentation performance compared to baker's yeast *S. cerevisiae* when using palm oil trunks sap as substrate medium. *S. cerevisiae* kyokai.7 can only produced high ethanol conversion if no competition within fermentation medium.

RECOMMENDATION

In order to improve this research, it is proposed to compare lots of different strain including bacteria to screen the best fermentative microorganism for bio-ethanol production from palm oil trunks sap. Fermentation product should be analyzed by gas chromatography-mass spectrometry (GCMS) to observe the others compound that may exist after fermentation was completed.

REFERENCES

[1] BNDES and CGEE. (2008). *Sugarcane-based Bioethanol : Energy for Sustainable*

[2] *Development*. (1st Edition). Rio de Janeiro: Banco Nacional de Desenvolvimento Econômico e Social

[3] Hahn-Hagerdal, B., Galbe, M., Gorwa-Grauslund, M. F., Liden, G. and Zacchi, G. (2006). Bio-ethanol- the fuel of tomorrow from the residue of today. *Trends Biotechnol.* 24:549-556

[4] Kun, L. Y. (Ed) (2003). *Microbial Biotechnology: Principle and Application.* Singapore: World Scientific Publishing Co. Pte. Ltd. 663

[5] Malaysian Palm Oil Council (2007). Past to Present. *Malaysia Palm Oil Sustainably produced since 1917*. 2-3

[6] Pereira, F. B., Guimaraes, P. M. R., Teixeira, J. A. and Domingues, L. (2010). Selection of Saccharomyces cerevisiae strains for efficient very high gravity bio-ethanol fermentation process. *Biotechnol Lett.* DOI 10.1007/s10529-010-0330-9

[7] Rashid, A. and Ibrahim, W. A. (2009). Second Generation Biofuels from Oil Palm Biomass: When Will it Become Bussiness Reality. 19-20 February 2009. *International Conference on Future of the Palm Oil Bussiness*. Thailand

[8] Sumathi, S., Chai, S. P. and Mohamed, A. R. (2008). Utilization of palm oil as a source of renewable energy in Malaysia. *Renewable and Sustainable Energy Reviews*. 12: 2404-2421

[9] Trummer, D. R. (2006). *Bio-fuels for the Malaysian Transport Sector*. Denmark: Malaysian - Danish Environmental Cooperation Programme

A Microscopic Simulation Model for Capacity Analysis of Single Carriageway Roads: The Methodology

Zamri Bin Bujang[1,*], Othman Che Puan[1]
[1]Department of Geotechnics and Transportations, Faculty of Civil Engineering,
Universiti Teknologi Malaysia
*bzamri@feng.unimas.my

Abstract
The current Malaysian procedure for a detailed evaluation of the capacity and effects of various road and traffic characteristics for single carriageway roads, which is adopted directly from the American HCM, is inadequate and inaccurate since several aspects used in the method such as the consideration of the recreational vehicles and trucks are not directly applicable to the Malaysian traffic characteristics. The validity of the analysis is debatable since the way in which the effect of motorcycles on overall performance of the roadways is considered is not clear. The existing simulation models of traffic operations on single carriageway roads also suffer from a similar weakness. Therefore, there is a need to develop a comprehensive traffic simulation model to carry out this task. Such a model must be capable of simulating traffic behavior for a range of road layout and geometry, at junctions and compositions of traffic which include motorcycles. This paper describes the development of a simulation model of mixed traffic on single carriageway roads to analyze the capacity and assess the accident risk for a given road geometry and traffic demand. The methodology of this study comprises two major phases, i.e. (1) model development and (2) application of the simulation model.

Keywords
Simulation model, mixed traffic, motorcycles, methodology.

INTRODUCTION

Traffic simulation modeling is becoming more attractive and effective tools in studying traffic issues. This enables traffic engineers and transportation planners to investigate the effect of changes in the network geometry, capacity analysis and traffic control strategies on traffic performance. The majority of traffic simulation tools have been developed specifically for homogeneous traffic flow and place less attention and consideration on the uniqueness of motorcycles. This may cause such theories and models to have difficulties when describing the mixed traffic flow. When modeling a mixed traffic flow, one should consider not only the sizes of different vehicle types, but also the particular interactions between these vehicle types.

WHAT IS MIXED TRAFFIC FLOW

In mixed traffic flow, vehicles can be defined in two categories [1]:

- Standard vehicles refer to conventional vehicles such as private cars, buses, light and heavy trucks that exhibit normal flow and queuing behavior
- Non standard vehicles refer to motorcycles, scooters and bicycles that exhibit abnormal flow and queuing behavior.

Figure 1 shows the difference between homogeneous traffic flows which has lane discipline and mixed traffic flow which has parallel or staggered entity following [2].

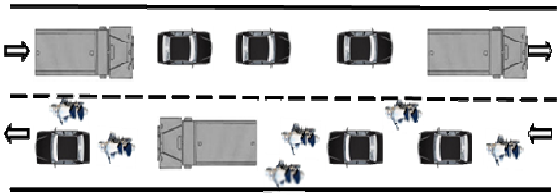


Figure 1 Car following on single carriageway road

CAPACITY ASSESSMENT METHODS

Capacity defined as a measure of the effectiveness of the road in accommodating traffic. According to TRB (1994), capacity is defined as the maximum hourly rate at which persons or vehicles reasonably can be expected to traverse a point or a uniform section of lane or roadway during a given period of time under prevailing roadway, traffic, and control condition [3]. Capacity is often evaluated using graphical representation of speed/flow/density relationship. HCM (TRB, 1994) suggests that the speed/flow/density relationships should be based on the plot of a series of short period observations to consider the short-term fluctuations in traffic demand.

FACTOR AFFECTING SPEED/ FLOW RELATIONSHIP AND CAPACITY

The operational characteristics of single carriageway roads are determined by the following factors:

- Lane width and lateral clearance

- Vertical and horizontal alignments
- Traffic composition
- Directional split
- Environmental effects
- Traffic interruptions

SIMULATION MODEL OF MIXED TRAFFIC FLOW

The main behavioral sub-models used in microsimulation in mixed traffic flow are described below.

Car following model

Car following model is of particular importance to traffic safety. Not only because close following with excessive speed is known to increase the risk for rear-end collisions, but also because car following behavior determines the distribution of gaps that exist at any particular point of measurement in a traffic stream. The car following model adopted for this study is the one described by Mahdi (1991). This model would provide sufficient large safe following distance so that there will be no rear-end collision if the preceding vehicle comes to a stop instantaneously [4]. Othman Che Puan (2004) proposed the following equations of car following distance relationships for Malaysian traffic characteristics [5]:

$$H_{(\text{all vehicles})} = 2.98 + 1.16V \quad (1)$$

$$H_{(\text{car - car})} = 1.26 + 1.19V \quad (2)$$

$$H_{(\text{car - HGV})} = 4.04 + 1.12V \quad (3)$$

$$H_{(\text{HGV - HGV})} = 9.33 + 1.21V \quad (4)$$

$$H_{(\text{HGV - car})} = 5.17 + 1.19V \quad (5)$$

Where H is the distance headway (m) and V is the vehicle speed (m/s).

Overtaking model

Related to the car following behavior is the overtaking behavior. Overtaking is one of the common phenomena that may be observed on single carriageway roads. If a slower vehicle is in front of the agent, it may decide to overtake this vehicle. This decision depends on the velocity difference between the two vehicles and the available space to overtake the vehicle, both in front and to the right of the other vehicle. The definitions of some of the variables used for simulating an overtaking manoeuvre are shown in Figure 2.

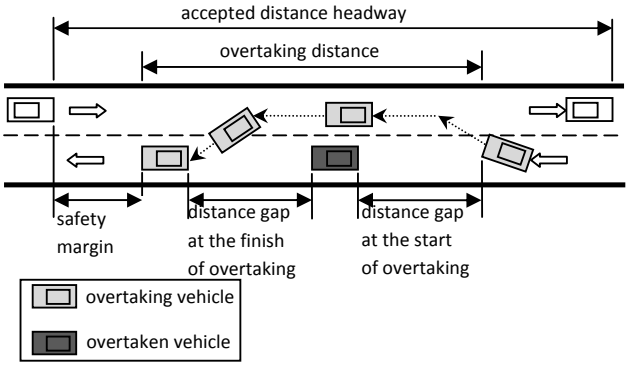


Figure 2 Definitions some of the overtaking variables [6]

Lane changing model

The modeling of lane-changing behavior in most micro-simulation models is at present restricted to dual carriageways and multi-lane motorways. The modeling of urban networks and isolated intersections therefore generally lacks this potentially unsafe form of behavior. Similarly, problems related to the process of parking and parked vehicles on urban link roads are very rarely modeled.

SIMULATION MODEL OF MIXED TRAFFIC FLOW CONTAINING MOTORCYCLES

Modeling the motorcycles behavior in mixed traffic flow can be divided into three categories: longitudinal following model, oblique following model and lateral following model as shown in Figure 3.

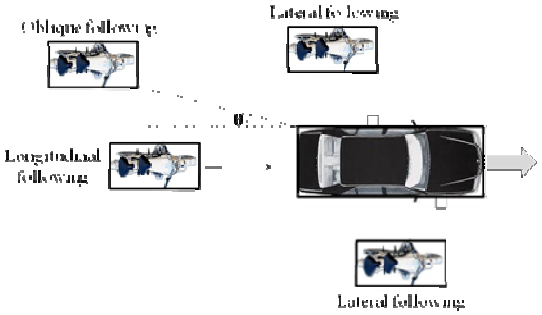


Figure 3 The regimes of the interactions between passenger cars and motorcycles

Longitudinal following model of a motorcycle The longitudinal following model describes the interaction between motorcycle and the vehicle in front. Given that a motorcyclist is steering his bike based on the principle of collision avoidance, the minimum longitudinal following distance he maintains, ΔD^{min}, can be formulated as $\min\{\Delta D^{unswerving}, \Delta D^{swerving}\}$ [7], i.e.

$$\Delta D_n^{min} = min\left\{v_n\tau - \frac{v_n^2}{2b_n} + \frac{v_{n-1}^2}{2b_{n-1}}, \Delta v_n\left(\tau + \frac{d^W}{v^W}\right) + \frac{1}{2}(b_n - b_{n-1})\left(\frac{d^W}{v^W}\right)^2 - \frac{1}{2}b_n\left(\tau + \frac{d^W}{v^W}\right)^2\right\}$$

(6)

where,

v_n : initial speed of vehicle n

d_n : stopping distance of vehicle n

b_n : braking deceleration of vehicle n under the circumstance of no swerving

τ : reaction time

d^W : lateral distance needed for avoiding a collision

t^W : time needed for making the lateral movement d^W

v^W : lateral speed of a motorcycle

Δv_n : speed difference, $\Delta v_n = v_n - v_{n-1}$.

Oblique following model of a motorcycle

The oblique headway is the safety distance a motorcyclist maintains when he is following another vehicle obliquely, i.e. following at the rear left or rear right of a preceding vehicle. The oblique following distance can be formulated by using the following equations [7]:

$$\Delta D_n^{oblique} = \sqrt{(\alpha_{long0} + \alpha_{long1}\Delta v_n + \alpha_{long2} v_{n-1})^2 \cos^2\theta + (\alpha_{lat0} + \alpha_{lat1}\Delta v_n)^2 \sin^2\theta}$$

(7)

$$\Delta D_n^{oblique} = \frac{(\alpha_{long0} + \alpha_{long1}\Delta v_n + \alpha_{long2} v_{n-1}) \times (\alpha_{lat0} + \alpha_{lat1}\Delta v_n)}{(\alpha_{long0} + \alpha_{long1}\Delta v_n + \alpha_{long2} v_{n-1})\sin\theta + (\alpha_{lat0} + \alpha_{lat1}\Delta v_n)\cos\theta}$$

(8)

Where $\Delta D_n^{oblique}$ is the oblique following distance, θ is the following angle. α_{long0}, α_{long1}, α_{long2}, α_{lat0}, α_{lat1} are coefficients.

Lateral following model of a motorcycle

The lateral headway is the safety distance between a motorcycle and another vehicle aside when the motorcyclist is overtaking or lateral following. This type of headway is a special case of the oblique headway with the following angle equal to 90°. Thus, the lateral headway is a function of the speed difference between these two vehicles. The lateral following distance can be formulated by using the following equations [7]:

$$\Delta D_n^{lateral} = \alpha_{lat0} + \alpha_{lat1}\Delta v_n$$

(9)

MODEL DEVELOPMENT PROCESS

Figure 4 shows the model development process which start from problem definition and the final result will be the application of the simulation model.

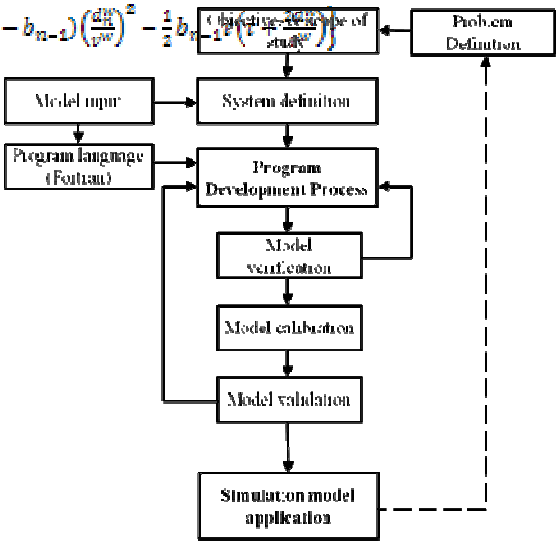


Figure 4 Framework of the Model Development Process

Program language

FORTRAN was the first high level programming language invented and is still used today for programming scientific and engineering applications. The personal computer-based FORTRAN compilers currently available such as FORTRAN90/95 and Window FORTRAN provide flexibility in terms of program data structure. FORTRAN will be used as a programming language in this study where a graphical display of the simulation result will be the end product.

Model input

The input data required by the simulation model to enable traffic to be simulated can be classified into three categories:

Table 1 Common input data used in most traffic model

Type of data	Information required
Physical characteristics:	
Single carriageway roads	• Length of the road section, number of lanes and width, horizontal & vertical alignments.
Priority junctions	• Location, number of approaches, types of traffic control
Traffic characteristics:	
Vehicular data	• Vehicle types, traffic flow and composition. • Directional flow, headway distribution.
Driver's data	• Desired speed & critical merging gap.
Simulation requirement	• Simulation time, accident data.

Model verification, calibration and validation

The processes for evaluating the reliability of the traffic simulation model involve three important tasks, i.e. model verification, calibration and validation.

Model verification

Model verification is done to ensure that the model is programmed correctly where the algorithms have been implemented properly and the model does not contain errors, oversights, or bugs. Verification ensures that the specification is complete and that mistakes have not been made in implementing the model.

Model calibration

Simulation model calibration generally refers to the process in which the individual components of a simulation model are adjusted or finely tuned so that the model accurately represents the data collected from field measurements according to predefined statistical tolerance levels.

Model validation

Validation is the process of comparing model results with the corresponding field observed values to ensure that such results realistically represent the real system.

Only measurable data from the field can be used to validate model results [8]. Model validation is concerned with testing the accuracy of the model by comparing traffic parameter values generated by the simulation model with values derived from relevant empirical data that has been collected in the field.

Model output

This research will focus on mixed traffic flow on single carriageway roads. The expected finding from this research will be a simulation model which is able to evaluate and analyze the capacity of single carriageway roads. The simulation model also can assess and evaluate the accident risks for a given section of single carriageway roads in Malaysia.

CONCLUSION

This study will include motorcycles in the simulation model on single carriageway roads in Malaysia. The interaction between motorcycles and other vehicles in the mixed traffic flow on the roadways will be simulated and finally, the capacity analysis on the effect of mixed traffic on capacity will be analyzed.

ACKNOWLEDGMENTS

This paper is based on the work done as part of my doctoral research at the Universiti Teknologi Malaysia, and I acknowledge the encouragement and support from Universiti Malaysia Sarawak and Universiti Teknologi Malaysia in my research and towards the writing of this paper.

REFERENCES

[1] Tiwari, G., *Traffic Flow and Safety: Need for New Models for Heterogeneous Traffic*. Injury Prevention and Control. Ed.: D. Mohan and G. Tiwari. London, Taylor and Francis.**:** 71–88 (2000)

[2] Hung-dung Cho, Yuh-Ting Wu, *Modeling and Simulation of Motorcycle Traffic Flow,* IEEE International Conference on Systems, Man and Cybernetics, (2004).

[3] Transportation Research Board, *Highway Capacity Manual*. Special Report 209. 3rd Edition TRB, National Research Council, Washington D.C.(1994).

[4] T. A. Mahdi, (Doctoral Dissertation), The Effect of overtaking provision on the *operating characteristics of single carriageway roads*, University of Wales Cardiff, (1991).

[5] Othman Che Puan, *Driver's Car Following Headway On Single Carriageway Roads*, Jurnal Kejuruteraan Awam 16(2): 15-27 (2004).

[6] Othman Che Puan, (Doctoral Dissertation), *A Simulation Study of Speed And Capacity of Rural Single Carriageway Roads*, University of Wales Cardiff, (1999).

[7] Tzu-Chang Lee, (Doctoral Dissertation), *An Agent-Based Model to Simulate Motorcycle Behaviour in Mixed Traffic Flow*, Centre for Transport Studies, Department of Civil and Environmental Engineering,Imperial College London, (2007).

[8] V. Thamizh Arasan, P. Vedagiri, *Estimation of Saturation Flow of Heterogeneous Traffic Using Computer Simulation*, 20th European Conference on Modelling and Simulation, (2006).

POSTER

SOCIAL SCIENCES

The Reciprocal Direct Investment between China and Malaysia Under International Investment Treaties

Liu Kai
Faculty of Law, Universiti Kebangsaan Malaysia, 43600, Bangi, Selangor D.E., Malaysia
liukai198352@163.com

ABSTRACT

With the integration of the global economy, the Foreign Direct Investment (FDI) among the developing countries becomes more and more popular. China and Malaysia respectively as the biggest developing country in the world and the powerful developing country in the Association of South East Asian Nations (ASEAN) have become the important investment associates with the development of Asian economy. This article concretely discusses the reciprocal direct investment between China and Malaysia under some important international investment treaties. It mainly analyzes them from four aspects, namely: Bilateral Investment Treaties (BITs)—Government Agreements between China and Malaysia, Multilateral Investment Treaties (MITs)—Washington Convention on the Settlement of Investment Disputes, MITs—World Bank Guidelines on the Treatment of Foreign Direct Investment and MITs—Agreement on Trade-Related Investment Measures. These treaties largely promote and standardize the reciprocal direct investment between China and Malaysia and consequently push the development of Chinese and Malaysian economies.

KEYWORDS

FDI, China, Malaysia, BITs, MITs.

INTRODUCTION

In the ASEAN region, Malaysia is the first country to establish the diplomatic relations with China as early as 31 May 1974 in virtue of signing the Joint Communiqué by Chinese then Premier Zhou Enlai and Malaysian then Prime Minister Tun Razak to announce the normalization of the bilateral relations. Since then, the friendly contacts and cooperation between China and Malaysia have developed in various fields. As far as the reciprocal direct investment between China and Malaysia is concerned, Chinese companies began investing in Malaysia in the 1990s. By 2006, China had already become the 8th largest investing country in Malaysia and the total amount of the investment was more than USD 1 billion according to the report of Chinese Outflow Foreign Direct Investment Statistic Yearbook 2006.[3] The direct investment involves in the steel, electric appliance and automobile manufacturing, etc. Malaysia began investing in China in 1984. Nowadays Malaysia has become the 15th largest investing country in China. According to the report of Central Bank of Malaysia (BNM), from the 1980s to now, the amount of the Malaysian direct investment in China attained USD 3.4 billion. Malaysian government has embarked on several collaborative measures with Chinese government via bilateral consultations and multilateral negotiations. Under the current framework of international investment law, the international investment treaties are generally classified into two categories—BITs and MITs. China and Malaysia have to obey these treaties as the premise to carry on their reciprocal direct investment in the legal practice.

BITS BETWEEN CHINA AND MALAYSIA

China had concluded the largest number of BITs (94) with other developing countries by 2000. Malaysia, with the number of BITs (63), was ranked 10th in the world at the same year.[4] By 2004, both of China and Malaysia had respectively signed more than 40 agreements with other developing countries, which had also signed more agreements with developing countries than with developed countries. With the sharp increase of the outflow FDI stock of the developing countries, China and Malaysia have been the larger FDI outflow countries since 1990. By 2004, Hong Kong, China; Malaysia and other 7 developing countries[5] had represented about 58% of the total outward FDI flows of developing countries. Moreover, by the same year, 312 double taxation treaties had been signed between 94 developing countries, which were mainly in South-East Asia. China and Malaysia accounted for the largest number of such treaties, followed closely by other Asian countries.

Generally speaking, these existing bilateral treaties between China and Malaysia are the best testimony of their favorable diplomatic relations and the direct result of their active bilateral cooperation. With the acceleration of the economic globalization and the regional integration, these bilateral agreements have already become one of the key guarantees to realize the win-win effect between China and Malaysia and the regional stabilization in Asia.

CHINA AND MALAYSIA UNDER SOME IMPORTANT MITS

[3] This report was published by the Ministry of Commerce of the People's Republic of China and the National Statistic Bureau of the People's Republic of China in 2007.

[4] See UNCTAD database on BITs in 2000: By 2000, the top 10 countries in terms of the number of BITs concluded are Germany (124), Switzerland (95), China (94), United Kingdom (92), France (92), Romania (90), Egypt (84), Italy (77), Netherlands (72) and Malaysia (63).

[5] These countries are India, Kazakhstan, Pakistan, Singapore, South Africa, Tunisia and Thailand.

Regarding the reciprocal direct investment between China and Malaysia, there are three most important MITs should be reviewed, namely Washington Convention on the Settlement of Investment Disputes, World Bank Guidelines on the Treatment of Foreign Direct Investment and Agreement on Trade-Related Investment Measures.

Washington Convention on the Settlement of Investment Disputes

In the Washington Convention, the relevant articles chiefly mention International Center for Settlement of Investment Disputes (ICSID) as the core content.[6] It is significantly considered as the important agency of the Washington Convention by all signatories to supply the different settlement solutions for investment disputes. As the main body, the ICSID is to provide facilities for conciliation and arbitration of investment disputes between contracting states and nationals of other contracting states in accordance with the articles of Washington Convention.

Chinese FDI under the Washington Convention

With the increase of domestic enterprise venturing overseas, China as the largest holder of foreign exchange reserves in the world has to incorporate the ICSID provisions as a protective measure in favour of Chinese enterprises investing overseas, including investing in Malaysia. Hence, China is trying to approach towards the ICSID provisions step by step, which is reflected in its recent BITs and Free Trade Agreement (FTA):

(1) At the initial stage of China's reform and opening-up, Chinese BITs did not contain the ICSID arbitration provisions. Nevertheless, with the deepening of China's economic reform, the milestone event of its accession to the WTO and its strategy of actively strengthening bilateral and regional cooperation appeared to be reshaping the landscape: from the late 1990s, this cautious stance was liberalized by the Chinese government through Ministry of Commerce, which could be seen in the recent Sino-Malaysia BITs and Sino-Germany BITs.

(2) The ICSID mechanism was also used in China's FTA engagements: at the time that China had not incorporated investor-state dispute settlement clauses in its FTA or FTA in nature deals with Hong Kong, Macao and ASEAN, it did reach an unlimited protocol with Pakistan to settle investor-state disputes at the ICSID forum. The Sino-Pakistan FTA provides that an investor may submit any legal disputes in connection with an investment in the territory of the state to the ICSID.

Malaysian FDI under the Washington Convention

In order to settle the investment disputes effectively and duly, latest Malaysian investment agreements are commonly with settlement provisions for referral of disputes as opposed to the litigation in accordance with the Washington Convention. Many Malaysian private enterprises even choose to include mandatory arbitration clauses when they signed investment contracts with other countries. For instance, there is a pending case of contractual investment dispute reported from U.S. Department of State between American and Malaysian companies that Malaysian company did not choose to honor mandatory arbitration clause as stated in their contact. Thus, the investment dispute cases, which had been rare formerly, have been generally handled satisfactorily by the existing dispute settlement mechanisms currently.

In addition, in order to clarify the responsibilities and obligations of the investment parties and consequently avoid unnecessary investment disputes, Malaysia has also concluded a series of bilateral Investment Guarantee Agreements (IGAs) as the complement of the ICSID, which are just the testimonies of government desiring to increase the confidence of foreign companies to invest in Malaysia.[7] For instance, Malaysia and Vietnam had signed the IGA in 1992. Under the new investment environment that Vietnam acceded to WTO in 2007, the representatives of Vietnamese government had a meeting with the Malaysian mission led by the Minister Tan Sri Muhyiddin Mohd Yassin from the Ministry of International Trade and Industry in July 2008. They agreed to review the previous IGA to strength the transparency of bilateral investment, to reduce the approval time and to thereby avoid investment disputes. Under the framework of the Washington Convention, these IGAs will further help Malaysia to protect against nationalization or expropriation; to ensure prompt and adequate compensation in the event of nationalization or expropriation; to provide free transfer of profits, capital and other fees; to ensure the settlement of investment disputes under the supervision of the ICSID.

World Bank Guidelines on the Treatment of Foreign Direct Investment

Chinese FDI under the World Bank Guidelines

The current Chinese domestic laws do not include any provisions that clearly state the relevant punishments, which seem to be too soft to restrict these illegal behaviors of foreign companies. Regarding this weakness, China needs the World Bank Guidelines as a powerful international legal standard to regulate the corresponding admission, treatment and protection of the FDI of its member countries to thereby avoid the occurrence of these illegal behaviors from the origination.

In addition, there are also some specific issues coming from the Chinese Insolvency Law and Chinese Company law: although these two Chinese domestic laws stipulate the procedures of company's insolvency, disbandment and liquidation, they can only apply to Chinese local enterprises, rather than foreign private enterprises. These procedures thereby become very complicated and verbose for foreign private enterprises

[6] There are 58 out of total 75 Articles relating ICSID in the Washington Convention, which cover Chapter I—ICSID, Chapter II—Jurisdiction of the Center, Chapter III—Conciliation/Request for Conciliation, Chapter IV—Arbitration and Chapter V—Replacement and Disqualification of Conciliators and Arbitrators out of total ten Chapters in this Convention.

[7] Malaysia has concluded IGAs with ASEAN, Organizations of Islamic Countries (OIC) and other 69 countries and regions.

if they want to withdraw their investment from China under the adverse situation. This had already led to many cases of South Korean private investors withdrawing investment from China secretly and illegally. These cases knock the alarm bell for China that: although China never practices the World Bank Guidelines as the basis of judgement for the international investment cases, for the sake of managing the withdrawal of foreign investment better, China should refer to the World Bank Guidelines (such as Clause 1 (a), (d), Article 6,[8] Part III; Article 7, Part III[9] and so on) as a valid complement of judgement from now on to make up the shortages of the Chinese domestic legislations and consequently averts the similar case befalling on other foreign companies in the Chinese territory, including the existing Malaysian companies.

Malaysian FDI under the World Bank Guidelines

Nowadays, Malaysia has been committed to a market-driven economy under the framework of World Bank and IMF. It has pursued a consistent program to reduce the role of Government and to promote private investment initiative in the growth process. With the flotation of the Ringgit and liberalization of the financial system, Malaysia gradually expands the original financing space to attract foreign private investment. The government thereby reconsiders to use the World Bank Guidelines as a compulsory international regulation to protect the future foreign investment under the new situation.

From 31 July 1998, Malaysian government began to relax the equity policy guidelines for all applications to invest in new as well as expansion or diversification projects in the manufacturing sector. The main measures and legal basis are reflected in the Equity Policies of the Malaysian Foreign Investment Committee Guidelines. These policies mainly include the Equity Policy Applicable to New Investment, Expansion or Diversification as well as the Equity Policy Applicable to Existing Companies. The core content of the former is that: (1) Foreign investors can now hold 100% equity irrespective of the level of exports, and the work permit requirements for foreign employees of companies with foreign paid-up capital of USD 2 million or more were eased. (2) This relaxation is applicable for all applications received from 31 July 1998 until 31 December 2000 to set up manufacturing projects with the exception of specific activities and products where Malaysian small and medium companies have the capabilities and expertise.[10] For these activities and products, the prevailing specific equity guidelines are applicable. (3) All projects approved under this policy will not be required to restructure their equity after the period. (4) This policy will be reviewed after 31 December 2000. The core content of the latter is that: (1) Companies which have been licensed before 31 July 1998 have to comply with the equity condition as stated in the license. However, for existing companies undertaking expansion or diversification, the former equity policy applies to the expansion and diversification projects. (2) The former equity policy also applies to the following two kinds of companies: Companies previously exempted from the manufacturing license but whose shareholders' funds have now reached RM 2.5 million or have engaged 75 or more full time employees; and existing licensed companies exempted from the equity condition which are required to inform the Ministry of International Trade and Industry (MITI) when their shareholders' funds reach RM 2.5 million.

Under the encouragement and guarantee of these equity policies and guidelines that Malaysia had been adopting, more and more Chinese private companies which have enough strength were favourably approved and successively investing in Malaysia.

Agreement on Trade-related Investment Measures

The main objective of the TRIMs Agreement is to advocate Members to eliminate those TRIMs which cause trade distortions. By means of the removal of barriers, the Agreement ensures free competition among Members, helps to expand the liberalization of world trade and facilitates the investments across international frontiers so as to increase the economic growth of all trading partners, especially the developing country members.

Chinese FDI under the TRIMs Agreement

After 13 years of negotiations with the United States, Canada and the European Union, China eventually acceded to WTO in 2001. It simultaneously meant that China must follow all the WTO rules, such as the TRIMs Agreement, the General Agreement on Trade in Service (GATS), the Agreement on Trade-relate Intellectual Property Rights (TRIPs) and so on.

At the same year, the 'Protocol on the Accession of the People's Republic of China' was published by the Chinese government, which declares that China will follow all general provisions, schedule and final provisions of the WTO after being a member. Regarding the TRIMs Agreement, Clause 3, Article 7 (Non-Tariff Measures), Proportion D (Judicial Review), Section 2 (Administration of the Trade Regime), Part I (General Provisions) of this Protocol states that: (1) China shall, upon accession, comply with the TRIMs Agreement, without recourse to the provisions of Article 5

[8] Clause 1 (d), Article 6, Part III of the World Bank Guidelines states that on liquidation or sale of the investment (whether covering the investment as a whole or a part thereof), each state will allow the repatriation and transfer of the net proceeds of such liquidation or sale and all accretions thereto all at once.

[9] Article 7, Part III of the World Bank Guidelines states that each state will permit and facilitate the reinvestment in its territory of the profits realized from existing investment and the proceeds of sale or liquidation of such investments.

[10] These activities and products are paper packaging, plastic packaging (bottles, films, sheets and bags), plastic injection moulding components, metal stamping, metal fabrication and electroplating, wire harness, printing and steel service centers.

(Notification and Transitional Arrangements) of the TRIMs Agreement. (2) China shall eliminate and cease to enforce trade and foreign exchange balancing requirements, local content and export or performance requirements made effective through laws, regulations or other measures. Moreover, China will not enforce provisions of contracts imposing such requirements.

Malaysian FDI under the TRIMs Agreement

In 1995, with the naissance of the WTO, the entry to the WTO of Malaysia and the enforcement of the TRIMs Agreement, Malaysia began to fully adopt the TRIMs Agreement. Similar to China, in order to actualize the original commitments to the WTO, Malaysia also had to notify the Council for Trade in Goods of all TRIMs being applied, which were not in conformity with its obligations under the TRIMs Agreement, and phased out these TRIMs within the prescriptive period. The original notification, which stated the TRIMs being applied in the selected motor vehicle industry, was submitted by the Malaysian government in 1995. On 18 March 1996, Malaysia also submitted a revised notification on the basis of the original one. Both the original and revised notifications stated the Malaysian policy on the local content requirements in the motor vehicle industry related to investment incentives.

In addition, on November 20, 2000, the Minister of the MITI of Malaysia, Datuk Seri Rafidah Aziz also announced the process of phasing out the local content policy in other realms. It involved the abolition of the Local Materials Contents Programme and the removal of eleven products[11] from the mandatory deleted items list for which local manufacturers have achieved international competitiveness.

Eventually, the compliance of the TRIMs Agreement in Malaysia was completed on December 31, 2003 with the elimination of all these TRIMs for both new and existing companies.

ACKNOWLEDGMENTS

I would like to take this opportunity to record my most sincere thanks all the professors and lecturers of Faculty of Law, UKM, for all the help and kindness they gave me in the whole progress of my research, especially, Prof. Dr. Aishah Bidin, the Dean of Faculty of Law, and Assoc. Prof. Dr. Hasani Mohd Ali, my supervisor. They did not only enlighten me on this research, but also gave me a lot of valuable advices for my future legal study.

REFERENCES

[1] Aiman Nariman Mohd Sulaiman, Aishah Bidin, Pamela Hanrahan, Ian Ramsay & Geof Stapledon, *Commercial Applications of Company Law in Malaysia,* 3rd ed., CCH Asia Pte Limited, Kuala Lumpur, Malaysia (2008).

[2] Asif H. Qureshi, *International Economic Law,* Sweet & Maxwell, London, England (1999).

[3] *Bank Negara Malaysia Annual Report 2006,* BNM, Kuala Lumpur, Malaysia (2006).

[4] Fan Jian & Jiang Daxing, *Chinese Company Law,* Nanjing University Press, Nanjing, China (1997).

[5] John Shijian Mo, *International Commercial Law,* 3rd ed., Chinese Legal Press & LexisNexis, Beijing, China (2004).

[6] Liu Xun, *Investment Measures and Control—Combination of China Acceding to WTO,* China Legal Press, Beijing, China (2001).

[7] Tham Siew Yean, *The Future of Industrialization in Malaysia under WTO,* Institute of Malaysia and International Studies, Universiti Kebangsaan Malaysia, Bangi, Malaysia (2004).

[11] They are coil springs, exhaust systems, external body protective moulding, relays, fuel tank, glass components, metal damping sheet, seat and slide assemblies, seat pads, windscreen washers and shock absorbers.

A Social Network Based Solution for Integrating the Universities in Malaysia

Vala Ali Rohani[1,*] and Siew Hock Ow [2]
[1, 2] *Department Of Software Engineering, Faculty of Computer Science and Information Technology, University Of Malaya, Kuala Lumpur, Malaysia*
* V.Rohani@siswa.um.edu.my

Abstract
This research aims to design an infrastructure which can be a platform for each Malaysian university to create its own social network. These academic social networks will be completely autonomous and will have their own dedicated administrator. Also, the supervision features can be included to gather valuable information for the use of the Malaysian institutions of higher learning.

Keywords
Social Network, Integration, Malaysian Universities

INTRODUCTION

The application of IT solutions and Web-based services in our daily life has caused the generation of a wide range of social networks. MySpace, Orkut, Facebook are some samples of these new technology approaches. For example, the necessity of a national social network to support information interchange for Iranian experts motivated us to create the Iranian experts portal [1]. This project, having good infrastructure and skillful features, could attract more than 130,000 Iranian experts4 to have their own official profile in it, and also make friends through networks. Think tank with more than 300 daily questions and 1,200 answers is another valuable outcome of this project as well.
The useful experiences gained from the development, technical maintenance and content management of IrExpert project, motivated us to develop a parametric model for generating autonomic and integrated social networks for the Malaysian university students and graduates. Using this model, each university will have its own independent social network which can provide the facilities to support the needs of the students and graduates.

LITERATURE REVIEW

The institutions of higher learning in Malaysia play an important role in broadening the knowledge horizons in Malaysia. Until 2008, the University of Malaya (UM) has produced more than 115,000 graduates in various disciplines. Table 1 illustrates the current intake statistics of UM [2].

Considering the important role of academic societies in developing the social structure of each country, we decided to provide an infrastructure for integrating the academic information of all universities and colleges in Malaysia.

Table 1: Intake Statistics of UM in Year 2009

	Local Students	International Students
Undergraduate	13,617	865
Postgraduate	5,826	2,098

So Taking a look and analyse a few current social networks can broaden our horizon in this specific project. There are three most popular social networks - FaceBook, MySpace and LinkedIn, which are introduced below.

Facebook

Facebook is a global social networking website that is operated and privately owned by Facebook, Inc [3]. Users can add friends and send them messages, and update their personal profiles to notify friends about themselves. Additionally, users can join networks organized by city, workplace, school, and region. The website's name stems from the colloquial name of books given at the start of the academic year by university administrations with the intention of helping students to get to know each other better.
Mark Zuckerberg founded Facebook with his college roommates and fellow computer science students Eduardo Saverin, Dustin Moskovitz and Chris Hughes while he was a student at the Harvard University [4]. The website's membership was initially limited to Harvard students only, but was expanded to other colleges in the Boston area, the Ivy League, and Stanford University. It later expanded further to include any university student, then high school students, and, finally, to anyone aged 13 and above. The website currently has more than 300 million active users worldwide [5].
Facebook has been banned at many places of work to discourage employees from wasting time using the service [6]. Privacy has also been an issue, and it has been compromised several times. Facebook settled a lawsuit regarding claims over source code and intellectual property. January 2009 Compete.com study ranked Facebook as the most used social network by the worldwide monthly active users, followed by MySpace [7].

MySpace

MySpace is a social networking website. Its headquarter is in Beverly Hills, California, USA, where it shares an office building with its immediate owner, Fox Interactive Media, which is owned by News Corporation. MySpace became the most popular social networking site in the United States in June 2006 [8]. According to comScore, MySpace was overtaken internationally by its main competitor, Facebook, in April 2008, based on monthly unique visitors [9]. MySpace employs 1,000 employees, after laying off 30% of its workforce in June 2009; the company does not disclose revenues or profits separately from News Corporation. The 100 millionth accounts were created on August 9, 2006, in the Netherlands [10].

LinkedIn

LinkedIn is a business-oriented social networking site. Founded in December 2002 and launched in May 2003, it is mainly used for professional networking. As of October 2009[update], LinkedIn had more than 50 million registered users, spanning more than 200 countries and territories worldwide [11].
The purpose of the site is to allow registered users to maintain a list of contact details of people they know and trust in business. The people in the list are called Connections. Users can invite anyone (whether a site user or not) to become a connection.

LinkedIn also allows users to research companies with which they may be interested to work with. When typing the name of a given company in the search box, statistics about the company are provided. These may include the ratio of female to male employees, the percentage of the most common titles/positions held within the company, the location of the company's headquarters and offices, or a list of present, past, and former employees.

The searchable LinkedIn Groups feature, allows users to establish new business relationships by joining alumni, industry, or professional and other relevant groups. LinkedIn groups can be created in any subjects and by any member of LinkedIn. Some groups are specialized groups dealing with a narrow domain or industry whereas others are very broad and generic in nature. The newest LinkedIn feature is LinkedIn Polls, but still in alpha phase.
A mobile version of the site was launched in February 2008 which gives access to a reduced feature set over a mobile phone. The mobile service is available in six languages: Chinese, English, French, German, Japanese and Spanish [12].

METHODOLOGY

Some foreseeable research questions in this project are as follows:

- What are the key requirements of social networks for educational environments?
- What will be the mechanism of content management?
- How should be the final organization for managing the infrastructure which will be developed as research outcome?

The Rational Unified Process (RUP) has been used as the methodology for developing the social network of this project. The RUP is an iterative software development process framework created by the Rational Software Corporation, a division of IBM since 2003. RUP is not a single concrete prescriptive process, but rather an adaptable process framework, intended to be tailored by the development organizations and software project teams that will select the elements of the process that are appropriate for their needs [13].

The RUP determines a project lifecycle consisting of four phases. These phases allow the process to be presented at a high level in a similar way to how a waterfall-styled project might be presented, although in essence, the key to the process lies in the iterations of development that lie within all of the phases. Also, each phase has one key objective and milestone at the end that denotes the objective being accomplished.

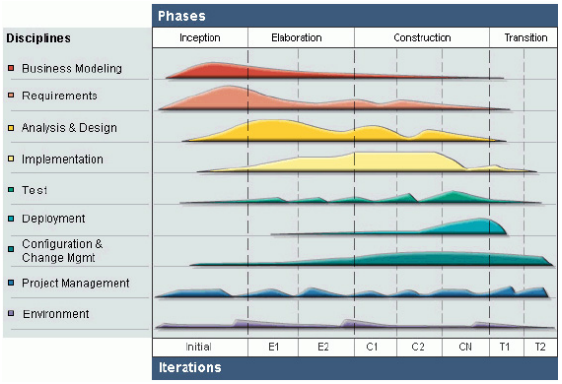


Figure 1. The Rational Unified Process (RUP)

The RUP determines a project lifecycle consisting of four phases. These phases allow the process to be presented at a high level in a similar way to how a waterfall-styled project might be presented, although in essence, the key to the process lies in the iterations of development that lie within all of the phases. Also, each phase has one key objective and milestone at the end that denotes the objective being accomplished.

Inception phase:

The primary objective is to scope the system adequately as a basis for validating initial costing and budgets. In this phase, the business case which includes business context, success factors (expected revenue, market recognition, etc), and financial forecast are established. To complement the business case, a basic use case model, project plan, initial risk assessment and

project description (the core project requirements, constraints and key features) are generated.

Elaboration phase:

The primary objective is to mitigate the key risk items identified by analysis up to the end of this phase. The elaboration phase is where the project starts to take shape. In this phase the problem domain analysis is made and the architecture of the project gets its basic form.

Construction phase:

The primary objective is to build the software system. In this phase, the main focus goes to the development of components and other features of the system being designed. This is the phase when the bulk of the coding takes place. In larger projects, several construction iterations may be developed in an effort to divide the use cases into manageable segments that produce demonstrable prototypes. This phase produces the first external release of the software. Its conclusion is marked by the Initial Operational Capability Milestone.

Transition phase:

The primary objective is to 'transition' the system from the development into production, making it available to and understood by the end users. The activities of this phase include training of the end users and maintainers and beta testing of the system to validate it against the end users' expectations. The product is also checked against the quality level set in the Inception phase.

OBJECTIVES OF THE RESEARCH

This study embarks on the following objectives:

To investigate:

- The International educational-based social networks.
- Current social networks in Malaysia.
- The different ways to integrate social networks.
- Issues on distributed databases to support integrated social networks.

To assess:

- The common requirements of social networks.
- Special requirements of Malaysian students as members of MUSGSN.
- Motivators that encourage students to join MUSGSN.
- Hardware and software requirements to setup an integrated social network.
- Network infrastructure to support the integrated social network.

To analyse:

- The structure of the Malaysian educational environments.
- MUSGSN model as a national infrastructure for creating the digital society of university students and graduates.

To develop

- Analysis model for MUSGSN project.
- Design model for MUSGSN project.
- Architecture of MUSGSN project.
- Data model for MUSGSN project.
- Distributed Servers diagram.
- A pilot portal (Web-based) to be used by the University of Malaya.
- A road map for expanding the MUSGSN project in a national-wide scale.

And to make recommendation based on:

- Survey outcomes of the current situations of Malaysian social networks.
- Survey outcomes of the international educational social networks.
- An infrastructure for integrationg other institutions of higer learning social networks.

CONCLUSION

This paper introduces a current research for developing an e-infrastructure to integrate all universities and higher education colleges in Malaysia.

The outcomes of this project include:

- Review of a few successful university social networks such as in the United States of America, Canada and Australia.
- Survey of social networks available in Malaysia and analyse the problems which they are facing.
- Gather the requirements from some faculties in UM pertaining to their needs of an academic social network.
- Design an infrastructure model to be used as a platform for creating the academic social networks for other universities.
- Propose a practical solution for integrating the Malaysian university social networks to gain the digital village of Malaysian universities.
- Develop a pilot social network for the students and graduates of the University of Malaya.

ACKNOWLEDGMENTS

The authors wish to acknowledge the collaborative funding support from the Fundamental Research Grant Scheme (FRGS). Under grant no. FRGS/1/10/TK/UM/02/14.

REFERENCES

[1] http:// www.IrExpert.ir, Last Updated: 5 October 2010. Retrieved 5 October 2010.

[2] UM Fact Sheet. 2009. http://www.um.edu.my/discover_um/um_fact_sheet.php?intPrefLangID=1&. Retrieved 25 November 2009.

[3] Eldon, Eric. 2008. "2008 Growth Puts Facebook In Better Position to Make Money". http://venturebeat.com/2008/12/18/2008-

growth-puts-facebook-in-better-position-to-make-money/. Retrieved 19 December 2008.
[4] "Founder Bios," Facebook. Retrieved 31 July 2009.
[5] "Facebook Statistics." Retrieved 18September 2009.
[6] Benzie, Robert."Facebook banned for Ontario staffers," TheStar.com, May 3, 2007. Retrieved 16 August 2008.
[7] Facebook. 2009. http://en.wikipedia.org/wiki/Facebook. Last Updated on 24 November 2009. Retrieved 25 November 2009.
[8] Pete Cashmore. 2006. http://mashable.com/2006/07/11/myspace-americas-number-one/, Last Updated on 11 July 2006.
[9] Techtree News Staff . 2008. "Facebook: Largest, Fastest Growing Social Network". http://www.techtree.com/India/News/Facebook_Largest_Fastest_Growing_Social_Network/551-92134-643.html. Retrieved 14 August 2008.
[10] Murdoch, Rupert. 2006. "Rupert Murdoch Comments on Fox Interactive Growth". http://internet.seekingalpha.com/article/15237. Retrieved 12 September 2006.
[11] "Latest LinkedIn Facts". 2009. LinkedIn. http://press.LinkedIn.com/about. Retrieved 14 October 2009.
[12] "Social-networking site LinkedIn introduces mobile version". tweakers.net. http://life.tweakers.net/nieuws/52094/social-networkingsite-LinkedIn-introduceert-mobiele-versie.html. Retrieved 2008-02-25.
[13] IBM Rational Unified Process Reference and Certification Guide: Solution Designer (RUP) by Ahmad K. Shuja and Jochen Krebs (Paperback - Jan 8, 2008)

Challenges Experienced By Malaysian Postgraduate Candidates Prior To Their Sojourn to Australia

Siti Salina Abdullah
Department of Psychology Counseling, Faculty of Management and Economics
University Malaysia Terengganu, 21030 Kuala Terengganu, Terengganu,
Malaysia
ctsalina@umt.edu.my

Abstract
The aim of this study was to highlight the experiences and challenges the Malaysian postgraduate candidates faced prior to their sojourn to Australia. Respondents were thirteen Malays Muslim postgraduate candidates (nine females, and four males) studying in universities in South Australia, Australia. Malaysian postgraduate candidates here refer to Malaysian candidates who were pursue their master degree or PhD at universities in South Australia. Those Malaysian candidates who were involved in this study were Malay ethnic and Muslim. The result revealed that these students choose Australia as a place for study based on expertise in study areas, courses offered as well as information from existing Malaysian students in Australia.

Keywords
International students, Malay Muslim postgraduate students.

INTERNATIONAL STUDENTS IN AUSTRALIA

Australia is a unique country, as it represents one of the English native countries as well as developed nations outside of Europe and North America. In terms of its geographic location, Australia is the nearest English native country for some Asian countries such as Indonesia, Malaysia and Singapore. In comparison with the US and the UK, Australia is regarded as the third largest country of international students' enrolment.

Internalisation in Australian higher education sectors began in 1951when Australia was involved in the Colombo Plan for Co-operative Development in the South and South East (Back, Davis, & Olsen, 1996). It was based on aid or assisting international students to further their studies in Australia. Meanwhile in the late 1970's, international education was still seen as aid assistance however the focus was market based and financial factors were followed by the commencement of 'Overseas Student Policy' in 1985. Since then, Australia has increased their focus on internationalisation as an important issue for universities (Meiras, 2004).

There are a large number of international students studying at Australian colleges and universities, and the numbers are increasing. In 2008, Australia hosted a record high of over 500,000 overseas students, with a growth of 20.7% from the previous year. The enrolments were recorded by students from more than 190 countries studying at learning institutions in Australia, where more than 75% of enrolled international students came from Asia, followed by increasing numbers from the Middle East, South America and Africa. Overall, in the year 2008, international students' enrolments in Australia came from the following countries: China (127, 276); India (97,035); Republic of Korea (35,376); Thailand (22,278); Malaysia (21,134); Nepal (18,063); Hong Kong (18,012); Indonesia (16,063); Brazil (16,028); and Vietnam (15,931)(Australian Education International, 2009).

The total of overseas or international students from Asia has increased over the past twenty years. It has been identified that due to the change in social and economic policies in Asian countries, the number of Asian students studying in Australia over the past two decades has changed (ABS, 2007). In 1985, five of the top ten countries of residence of students arriving in Australia for education purposes were Malaysia, Indonesia and Singapore (South East Asia); Hong Kong and Japan (North East Asia.). Ten years later, China represented 17% of international students in Australia while others were South Korea (8%), Japan (7%) and Malaysia (6%).

METHODOLOGY

In this study a total of thirteen Malaysian postgraduate students participated in an individual interview, nine females and four males (Table 1). All participants were Malay, studying at universities in South Australia and ranged in age from 27 to 42 years. The length of their stay in South Australia ranged from six months and three years of stay. The majority of the participants were undertaking PhD programme, while were others doing their Masters degree. All students were married and sponsored by the Malaysian Government.

We followed the thematic analysis procedures (Braun & Clarke, 2006) that enables the identification analysis and reporting pattern (themes) within data. Initially, interview transcripts were read several times in their entirety to capture the full content of the participants' narratives. Segments of the interviews were then identified as meaning units and summarised into property statements closely reflecting the

language of the participants. These involved five phases which are; familiarizing with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing the report.

Table 1. Demographic Characteristics of Participants

Code	Age (years)	Sex (M/F)	Length of stay at Australia (months)	Current Courses
S1	42	F	26	PhD
S2	35	M	6	PhD
S3	28	F	6	PhD
S4	34	F	7	Master
S5	35	M	7	PhD
S6	27	F	6	PhD
S7	36	F	42	PhD
S8	34	M	6	Master
S9	33	M	18	Master
S10	40	F	24	PhD
S11	41	F	18	Master
S12	28	F	16	PhD
S13	34	F	12	PhD

Note: S=Student; M=male, F=female

RESULTS

Asked to describe a preparation before further study at Australia, the largest number of respondents identified the reason for choosing Australia as a study destination (Figure 1).

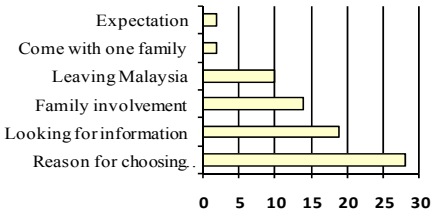


Figure 1. Prior Coming to Australia

There were six items discovered that described the reason these students further their study at Australia: required by their employers, the availability of experts in research area, the only offer received, location, own satisfaction and the course offered. The second majority of response identified was looking for information prior to arriving in Australia. There were two items described: participants did research for information, the use of technology in order to find information. Several responses referred to family involvement in plan to study overseas. This was an interesting response as some participants choose to discuss with their parents, spouse and family members while others decided to disclose only to friends. Other categories of response centred on the issue of leaving Malaysia where two items noticed: participants had mixed feeling and broken heart to leave Malaysia and their families for a while. Finally, some responses focused on the decision to come to Australia with one's family and expectation for a new life in Australia. Details of the participants' responses are described below.

Discussion and Recommendations

The purpose of this study was to investigate the characteristics, needs and expectations of married Malaysian postgraduate students, to examine how these students view the internal and external resources available to them at the time of their arrival in Australia, as well as to explore the types of obstacles they encountered and strategies they used to overcome them. While the majority of research to date has focused on the adjustment of international students in general, this study focused on a sample of married Malaysian postgraduate students studying in Australia, more specifically in South Australia. This study contributes to international students' literature by studying married international students in Australia, a population not widely studied in international student adjustment.

Similar with other researchers (Barker, Child, Gallois, Jones, & Callan, 1991; De Verthelyi, 1995; Novera, 2004), the present study agrees that married postgraduate international students represent a unique perspective for studying their adjustment experience. There is a need to better understand the physiological as well as psychological factors relevant to how these married postgraduate international students cope with study life as well as with family demands. By investigating married Malaysian postgraduate international students in Australia, our study contributes to the postgraduate international students' literature by expanding our understanding of postgraduate international students' issues in particular the Malaysian Muslim cultural context.

This research has highlighted three aspects related to the experience of married Malaysian postgraduate students in the Australian environment, which are the characteristics of Malaysian students prior coming to Australia, the significances of difficulties living in Australia and the strategies used to cope with living in Australia. These aspects are discussed sequentially.

These findings indicated that the main reason which contributed to the participants' journey to Australia was their purpose to Australia itself which consisted of the following six factors: requirements by their employers, expert availability, offers received, location, own satisfaction and the course offered.

The majority of participants reported that they were required by their employers to further their studies overseas. The findings support the objective of the Malaysian Ministry of Higher Education to ensure that at least 75% of academic staff at public universities and 30% of lecturers in polytechnic and community colleges hold a degree at the Masters level, PhD level or equivalent ("Kementerian Pengajian Tinggi", 2009). Therefore, the majority of the participants in this study were academic staff at Malaysian public universities as they were encouraged by their employers to enhance their academic competencies by improving their academic qualifications. In contrast with other research (Mazzarol & Soutar, 2002), the students' decision to study overseas was influenced by their family, especially their parents. For example, in the case of Taiwanese students, they were forced to study in the USA as many of their parents had relatives in this country. Our findings suggest that this policy needs to be maintained as it will be beneficial for the academic staff at public universities to obtain overseas exposure to enhance their knowledge in their discipline area. Furthermore, it will benefit the universities' productivity as well as the Malaysian government as more research and new findings will be discovered. These result suggests that the Malaysian Ministry of Higher Education works closely with the Australian Embassy in Malaysia, IDP Australia and other agencies to conduct more road shows or to visit Malaysian public universities in order to provide relevant information to potential Malaysian postgraduate internationals, the majority of which are university academic staff.

Consistent with other research (Mazzarol, Kemp, & Savery, 1997; Mazzarol & Soutar, 2002; Shanka, Quintal, & Taylor, 2006), this study agree that location, or geographic proximity also contributes to the international students' decisions to study overseas. For example, Indonesian international students selected Australia as their study destination choice as Australia is one of the closest countries to Indonesia. However, although these Indonesian international students did feel that location was an important factor which contributed to their study destination, it did not apply to most international students (Mazzarol & Soutar, 2002). Nevertheless, for Malaysian postgraduate international students in this study, the location of Australia as the nearest English-speaking country to Malaysia appeared to be an important factor for them. The reason this geographic proximity contributed to the participants' decision was not directly explored in the interviews therefore it is not possible to explain why some participants felt the rationale for this factor.

Other related factors associated with the reasons Malaysian postgraduate international students choose Australia as their study destination are the expert availability and the unique courses offered by Australian universities. These findings are consistent with the research conducted by (Mazzarol, 1998) that highlighted three phases of study destination choices which are: the decision to study overseas, push factors within the home country and pull factors from the potential host country. Mazzarol (1998) stated that staff expertise and a wide variety of courses offered by certain universities were the pull factors for the international students' study decisions. Therefore, our findings suggest that in order to market more international students, Australian universities should offer exclusive packages which include the unique and credible programmes or courses as well as assigning more experts as their academic staff. As participants in this study highlighted these two criteria, it proved that by offering the demanded courses and having the ability of strong staff expertise helps to attract more international students to choose Australia as their study destination.

The second factor which influenced the participants' decisions to study in Australia appears to be a search for information. These findings are consistent with the findings of other research into the push-pull factors influencing international students' destination choice (Mazzarol & Soutar, 2002). According to Mazzarol & Soutar (2002), the selection of study destination choice depends on the amount of information and the students' degree of understanding about a particular host country: the more they know, the more likely they will select it as a study destination.

Therefore, it is understandable and may explain why Malaysian postgraduate international students choose Australia as their study destination as they prepare themselves by searching for relevant information about Australia, universities, courses offered and contact person availability. To assist the potential Malaysian postgraduate students to find more relevant information, our study suggests these students maximize the use of technology such as telephone, Internet, email and blogs and have contact with other Malaysians prior to their arrival in Australia. As mentioned by one participant in this study, the information given by the Malaysian students who are already in Australia helped the participant prepare mentally and physically. Therefore, the technology and information provided by other Malaysians who are already in Australia is helpful in making the searching process easier for these Malaysian postgraduate students.

This study indicated that family involvement is important in the participants' decision making. The value placed on respect to elders by the Malaysian culture (Abdullah, 1996) influences the participants' decision to share their plans with their parents and other family members. In the Malay hierarchical-based society, respect for elders is important as it shows their loyalty to senior elders (orang tua) as wise

people who can guide and show them the way (Abdullah, 1996). Therefore it is understood why the participants involved their family members in their decision making. As Malays saying: "The elders are respected, the young are comforted" (Yang tua dihormati, yang muda di sayangi).

This findings revealed that to avoid future problems, not many participants choose to come separately with their nuclear family to Australia. The finding supports previous research that partners and families can provide social support for international students (Hayes & Lin, 1994; Pedersen, 1991). The findings help to explain the Malay values that are often associated with a sense of interdependence, being cooperative and living in a harmonious relationship (Abdullah, 1996). As Abdullah (1996) explained, peace and harmony in one's surroundings and lives are important for Malays as it relates with collectivism practices among Malays. The Malay sayings of 'United we stand, divided we fall' (Bersatu kita teguh, bercerai kita roboh) and 'The liquid is collective because of the container, opinions become agreeable due to consensus'(Bulat air kerana pembetung, bulat kata kerana muafakat) show the values of harmony and collectivism among Malays. However, due to certain circumstances, two participants had made the decision to live separately from their families for a while before the family arrived in Adelaide.

CONCLUSIONS

Based on this present study, it can be concluded that as international students the Malaysian postgraduate students do face challenges PRIOR TO HTEIR ARRIVAL TO Australia. Challenges can contribute to the students's stressors as it then affect their academic performances as well as their daily lives. Therefore, it is hoped that the present study will help future Malaysian postgraduate students improve their preparation prior to coming to Australia. Also, the Malaysian government together with the Malaysian Student Department in Australia should facilitate more effort to help these students manage their lives in Australia thus completing their study on time and returning to serve their country.

REFERENCES

[1] Abdullah, A. (1996). *Going glocal: Cultural dimensions in Malaysian management*: Malaysian Institute of Management.

[2] ABS, A. B. o. S. (2007). International Students in Australia. Retrieved 31 March 2007, from http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/66E07209141CE61FCA25732F001C9B8D/$File/41020_International%20students%20in%20Australia_2007.pdf

[3] Atlas of Student Mobility: United Kingdom. (2009). Retrieved 4 December 2009, from http://www.atlas.iienetwork.org/?p=48047

[4] Back, K., Davis, D., & Olsen, A. (1996). *Internationalisation and Higher Education: Goals and Strategies*. Retrieved 22 September 2009. from http://www.dest.gov.au/archive/highered/eippubs/eip9615/front.htm.

[5] Barker, M., Child, C., Gallois, C., Jones, E., & Callan, V. J. (1991). Difficulties of overseas students in social and academic situations. *Australian Journal of Psychology, 43*(2), 79-84.

[6] Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology, 3*(2), 77-101.

[7] Constantine, M. G., Anderson, G. M., Berkel, L. V. A., Caldwell, L. D., & Utsey, S. O. (2005). Examining the cultural adjustment experiences of African international college students: A qualitative analysis. *Journal of counseling psychology, 52*(1), 57-66.

[8] Department of Foreign Affairs and Trade, D. (2009). International Students. Retrieved 20 July 2009, from http://www.dfat.gov.au/aib/ tourism_students.html

[9] De Verthelyi, R. F. (1995). International students' spouses: Invisible sojourners in the culture shock literature. *International Journal of Intercultural Relations, 19*(3), 387-411.

[10] Gillard, J. (2009 28 July 2009). International education – its contribution to Australia.

[11] Hayes, R. L., & Lin, H. R. (1994). Coming to America: Developing social support systems for international students. *Journal of Multicultural counseling and Development, 22*, 7-7.

[12] IELTS. (2009). Retrieved 29 December 2009, from http://www.ielts.org

[13] Kagan, H., & Cohen, J. (1990). Cultural adjustment of international students. *Psychological Science, 1*(2), 133-137.

[14] Kementerian Pengajian Tinggi. (2009). Retrieved 14 December 2009, from http://ms.wikipedia.org/wiki/Kementerian_Pengajian_Tinggi_Malaysia

[15] Lee, J. J., & Rice, C. (2007). Welcome to America? International student perceptions of discrimination. *Higher education, 53*(3), 381-409.

[16] Mazzarol, T. (1998). Critical success factors for international education marketing. *International Journal of Educational Management, 12*(4), 163-175.

[17] Mazzarol, T., Kemp, S., & Savery, L. (1997). International students who choose not to study in Australia: An examination of Taiwan and Indonesia. *Australian International Education Foundation, Canberrra*.

[18] Mazzarol, T., & Soutar, G. N. (2002). Push-pull' factors influencing international student destination choice. *International Journal of Educational Management, 16*(2), 82-90.

[19] McMurthie, B. (2001). Arab Students in US Head Home, Citing Growing Hostility. *Chronicle of Higher Education*.

[20] Meiras, S. (2004). International education in Australian universities: Understandings, dimensions and problems. *Journal of Higher Education Policy and Management, 26*(3), 371-380.

[21] Novera, I. A. (2004). Indonesian postgraduate student studying in Australia: An examination of their academic, social and cultural differences. *International Education Journal, 5*(4), 475-487.

[22] Pedersen, P. B. (1991). Counselling international students. *The Counselling Psychologist, 19*, 10-58.

Factors Influencing Self-Efficacy In Environmental Education Amongst Malaysian Secondary School Teachers

Masitah Hj. Mohammad. Yusof [1], Ahmad Makmom Abdullah[1] , Bahaman Abu Samah[2], Ramli Basri[2] & Azizi Muda[3]
[1]Faculty of Environmental Studies, UPM, [2]Faculty of Educational Studies, UPM
[3]Faculty of Social Science and Humanities, UPSI
*iammasitah@gmail.com

Abstract
The aim of this study was to identify the antecedents of teachers' self-efficacy in Environmental Education. The factors were teachers' knowledge, attitudes and awareness towards environment, teachers' perception towards school principals' instructional leadership practices, teachers' background factor and school location factor. This study involved 300 teachers from 30 Malaysian Daily Secondary School from the states of Perlis represents Northern Zone, states of Selangor represents Central Zone, states of Pahang represents Eastern Zone, states of Malacca represents Southern Zone and states of Sarawak represents East Malaysia. Nevertheless, the analyses of the study were based on 263 sets (87.7%) of completed questionnaires from 283 questionnaires collected. Descriptive statistics (mean, standard deviation, frequency and percentage) and inferential statistics (t-test, one-way ANOVA, correlation Pearson r and multiple linear regressions) were utilized to analyze and present the findings. Overall, the findings showed that the level of teachers self-efficacy in Environmental Education were moderate (M=3.53, SD=.30). Findings also showed that teachers' perception towards school principals' instructional leadership practices (M=3.36, SD=.77), teachers' knowledge about Environmental Education and Environmental Issues (%M= 57.05, SD=9.74) and teachers' awareness towards environment (M=3.60, SD=.58) were moderate. Yet, the results reported that teachers' attitudes toward environment was positive (M=4.22, SD=.42). The findings also showed that there is a significant and positive relationship between teachers' self-efficacy and teachers' academic qualifications (r=.148, p=.017), teachers' attitudes towards environment (r=.440, p=.000), teachers' awareness towards environment (r=.462, p=.000) and teachers' perception towards school principals' instructional leadership for all the three dimension that is Dimensional of Defining the School and the Environmental Goal (r=.185, p=.003), Dimension of Instructional Management Programs and Environmental Programs (r=.150, p=.015) and Dimensional of Climate Nurturing Teaching and Learning of Environmental Education (r=.277, p=.000). The findings showed that the predictors of teachers' self-efficacy were teachers' awareness towards environment (Beta=.323, p=.000), teachers' perception towards school principals' instructional leadership for Dimensional of Climate Nurturing Teaching and Learning Environmental Education (Beta=.298, p=.001), teachers' attitudes towards environment (Beta=.234, p=.000), teachers' perception towards school principals' instructional leadership for Dimensional of Instructional Management Programs and Environmental Programs (Beta=-.219, p=.012), teachers' age (Beta=-.191, p=.000) and teachers' academic qualification (dummy variable 1=Masters) (Beta=.129, p=.014). All those factors only explained 34.4% of the variance of teacher self-efficacy in Environmental Education. This finding proved that there are other variables that influence teachers' self-efficacy. According to the findings, several suggestions were suggested to school, Ministry of Education and researchers in future.

INTRODUCTION

Educational play an important role in shaping the mind, thoughts and attitude towards the goodness. Environmental Education (EE) also emphasizes in changing minds, attitudes and practices towards caring for the environment in any action taken. According to Palmer (1998:7): "Environmental Education is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness amongst man, his culture, and his biophysical surroundings. Environmental Education also entails practice in decision-making and self-Formulation of behavior about issues concerning environmental quality." In the Malaysian context, EE has been officially introduced with the publication of Guidebook of Environmental Education Teacher Cross Curriculum for Primary and Secondary Schools (1998) by the Curriculum Development Division, Ministry of Education. For the preschool this book was published in 2005. Nevertheless, according to Pudin, Tagi and Periasamy (2004), the effectiveness of its implementation is still limited and unequal implementation amongst schools. They stated that: ".... many strategies have been initiated to integrate Environmental Education into the national education curriculum. Although the Ministry of Education provides a Guidebook on Environmental Education to all schools, the implementation has been limited and uneven. "

The question is, whether the teacher is capable or has high self-efficacy to integrate and incorporate the values of EE in the field of curriculum and co-curriculum in school? Are teachers able to produce students who acquired the positive attitudes and have the skills to enable them to play an active role in solving problems related to environmental issues in practical? These questions can be unfolded by motivating teachers to integrate EE in teaching and learning process effectively and meaningfully. Therefore, this study attempted to find out what factors contribute to the improvement of skills, abilities or self-efficacy of teachers in the implementation of EE in schools.

OBJECTIVE OF STUDY

1) To identify the teachers' knowledge, attitudes and awareness level towards the environment, teachers' perception towards school principals' instructional leadership level and levels of teachers' self-efficacy in implementation of the EE; 2) To determine whether was there a significant relationship between teachers' background factors, school location factors, teachers knowledge, attitudes and awareness towards the environment as well as teachers perceptions towards school principals instructional leadership practices and teachers' self-efficacy in implementation of the EE; 3) To study the selected factors of teachers' background factors, school location factor, teachers knowledge, attitudes and awareness factors towards the environment as well as teachers' perceptions towards school principal instructional leadership practices contribute to teachers' self-efficacy in implementation of EE.

Operational definition

Self-efficacy is defined as a person's consideration of its ability to manage and implement the actions needed to achieve the performance been set. It is also associated with a person's skill but it is more of a person's judgments about any issues that can be done using skills own (Bandura, 1986). In this study, self-efficacy refers to the two scales developed by Sia (1992) which are Personal Environmental Education Teaching Efficacy Belief Scale and Environmental Education Teaching Outcome Expectancy Scale, while the factors identified to affect teacher self-efficacy in this study were (i) teachers' knowledge towards EE and environmental issues (ii) teachers' attitudes towards environment (iii) teachers' awareness towards environment (iv) teachers' perceptions towards school principals instructional leadership practices (v) teachers' background factors and (vi) school location factor.

Leadership in environment concept is viewed as a leader who has the passion towards environment. Environmental leadership refers to leaders who have the personality, appreciate and love the environment. Hence, in the context of this study leadership in environment refers to school principals and how the principals show their leadership in instructional field exert to set in motion the energy within a group in order to enhance and applied EE in their perspective schools. Based on the concept model by Hallinger and Murphy (1987), researchers have adopted the instructional leadership to the concept of environmental instructional leadership that has been divided into three dimensions, namely (i) Dimensional Interpretation of School Goal and Objective of the Environment, (ii) Dimensional of Teaching Management Program and Environment Programmed (iii) Dimensional of Climate Nurturing Teaching and Learning of EE.

METHODOLOGy

This study is descriptive-correlation study. Descriptive statistics were used so that this study can be presented in a simpler, detailed and meant to facilitate understanding. Correlation is a good example of a quantitative exploration study (Langenbach 1994: 88). According to Sulaiman (1991) correlation is one way that can be used to describe the relationship between the two samples or two variables. In addition, this study is a descriptive survey study of teachers in secondary schools in Malaysia. According to Mohd Majid Konting (2005), descriptive research aims to explain a phenomenon that is taking place. Besides this, survey method is the specific way to gather information about a population (Blake & Champion, 1976). In this study, quantitative research methods are based on the collection information from the sample study. This study involved 300 teachers from 30 Malaysian Daily Secondary Schools selected from the five states of Perlis, Selangor, Pahang, Malacca and Sarawak. The method used is based on a stratified random sampling method. However, only 263 sets of completed questionnaires (out of 283 sets of collected questionnaires) are used to analyze the data. The total of respondent (n = 263) meet the sample size that had been calculated by the *GPower* programs with alpha value; $\alpha = .05$, effect size value = 0.15(middle) and the actual power or 1-β test statistics inferential value = 0.95.

RESEARCH FINDINGS

The findings of this study showed that the level of teachers knowledge generally was moderate (*%M*=57.05, *SD*=9.74). Specifically, the level of teachers knowledge on EE was moderate *(%M*=49.35, *SD*=13:45) and the level of teachers knowledge on the environmental issue is also moderate (*%M* = 64.75, *SD* =13.97). The findings also revealed that teachers' showed a positive attitudes towards environment (*M*=4.22, *SD*=.42) and a moderate level of awareness towards environment (*M*=3.60, *SD*=.58). The findings also identified that teachers' perceptions towards school principals instructional leadership practices in EE is moderate (*M*=3.36, *SD*=.77). Specifically,

teachers' perceptions towards school principals instructional leadership practices for the first dimension (*M*= 3.19, *SD*=.87), second dimension (*M*=3.10, *SD*=.92) and third dimension (*M*=3.54, *SD*=.77) is moderate. The findings of this study showed that teachers self-efficacy in implementation of EE is moderate (*M*=3.53, *SD*=.30). Specifically, the level of teachers self-efficacy for Environmental Education Personal Teaching Efficacy Beliefs Scale is also moderate (*M*=3.29, SD=.32). Instead, the results showed the level of teacher self-efficacy for Environmental Teaching Outcome Expectancy Scale were high (*M*=3.82, *SD*=.43).

The results have shown that male teachers level of efficacy (*M*=3:54, *SD*=.31) are higher than female teachers (*M*=3.53, *SD*=.30); a teacher who is a Masters holders level of efficacy (*M*= 3.65, *SD*=.31) are higher than teacher who is a Degree holders (*M*=3.51, *SD*=.29); The Senior Subject Teachers (*M*=3.53, *SD*=.32) and The Head of Panel (*M*=3.53, *SD*=.29) showed a high level of efficacy; teachers who attended the staff development programs on EE (*M*=3.55, *SD*=.32) have higher level of efficacy compared to teachers who did not attended the staff development programs on EE (*M*=3.52, *SD*=.29); teachers who teach in rural schools has a higher level of efficacy (*M*=3.56, *SD*=.29) than teachers who teach in the urban schools (*M*= 3.49, *SD* =.30). Teachers under the age of 30's have higher level of efficacy (*M*=3.62, *SD*=.26) compared to teachers in the age range of 56-58 years old (*M*=3.39, *SD*=.37); new teachers who has taught under 6 years have higher level of efficacy (*M*=3.61, *SD*=.26) than teachers who have taught between 12-16 years (*M*=3.48, *SD*=.33); while teachers who have holding the post for 16-20 years have higher level of efficacy (*M*=3.60, *SD*=.29) than teachers who holding the post for 11-15 years (*M*=3.45, *SD*=.37).

Teachers who level of EE knowledge is very weak have a higher level of efficacy (*M*=3.56, *SD*=.12) than teachers who have higher level of EE knowledge (*M*=3.52, *SD*=.30). In contrast, teachers with moderate level of knowledge on environmental issues have a higher level of efficacy (*M*=3.55, *SD*=.30) than teachers who have very low level of knowledge on environmental issues (*M*=3.35, *SD*=.30). Teachers with positive attitude towards environment shows high level of self-efficacy (*M*=3.55, *SD*=.29) compared to teachers with neutral attitudes towards environment (*M*=3.27, *SD*=.32). Teachers who have a high level of environmental awareness have a higher level of efficacy (*M*=3.65, *SD*=.30) than teachers with low level of awareness (*M*=3.22, *SD*=.28). The findings also concluded that school principals who practiced high level of instructional leadership showed their teachers with high level of efficacy (*M*=3.60, *SD*=.30) than school principals who practiced low level of instructional leadership (*M*=3.46, *SD*=.35).

The study also showed that there was a positive significant relationship between teachers self-efficacy with academic qualification factors (r=.148, p=.017), teachers' attitude towards the environment factors (r=.440, p=.000), teachers' awareness towards environment factors (r=.462, p=.000) and teachers' perceptions towards school principals' instructional leadership practices factors for all the three dimension namely Dimension 1: Defining the School and the Environmental Goals (r=.185, p=.003); Dimension 2: Instructional Management Programs and Environmental Programs (r=.150, p=.015); and Dimension 3: Climate Nurturing Teaching and Learning of EE (r=.277, p=.000).

The findings showed that teachers' self-efficacy predictors consists only six of the independent variables. The six independent variables were teachers awareness towards environment (Beta=.23, *p*=.000), teachers perceptions towards school principals' instructional leadership practices for the Third Dimensional of Climate Nurturing Teaching and Learning of EE (Beta=.298, *p*=.001), teachers' attitudes towards environment (Beta=.234, *p*=.000), teacher perceptions towards school principals' instructional leadership practices for the Second Dimensional of Instructional Management Programs and Environmental Programs (Beta= -.219, *p*=.012), teachers age (Beta= -.191, *p*=.000) and teachers academic qualifications (dummy variable 1= Masters) (Beta=.129, *p*=.014). These variables can only explain 34.4% variance of teachers' self-efficacy.

DISCUSSIONS

The finding shows that Malaysian Daily Secondary School Teachers have the moderate level of environmental knowledge, positive attitude towards environment and moderate level of awareness towards environment. Although many efforts have been undertaken, the level of awareness and attitude of the society still reflect their uncaring attitude in caring and conserving the environment (Ahmad Salihin, 2004). These findings support the study done by Krantz (2002) which states that teachers' level of knowledge causes teachers to teach EE according only the parts or topics that they understand. Scientific or global topics are less touched by teachers. This finding also supports the study done by Sia (1992), who found that teachers realized they do not have high level of EE knowledge but they believed that effective teaching will develop students' understanding of the EE.

The findings from this research proved that according to teachers' perception, school principals' demonstrated experience and confidence characteristics in instructional leadership at moderate level but according to school principals' perception,

they practice a high level of instructional leadership (Shafari, 2001). Meanwhile, a study done by Shahrom (1999) showed that school principal had played their role in all aspects of instructional leadership. Instead Basset, Creme and Walker (1974) in their findings indicated school principals as instructional leaders are at a level that is less favourable. Findings of a study done by Peter & Rijeng (2000) and Munira (2000), found that school principals practiced leadership abilities and performed their function as instructional leaders. The study done by Baharom (1998) and Abdullah Ismail (2001) shows the school principal implement functions of instructional leadership frequently and satisfying. The study done by Baharom (1998) also found that teachers' perceptions towards school principals' instructional leadership affect their job satisfaction. This indirectly gives the impression that the instructional leadership of school principals can lead to motivate teachers in performing their duties.

The findings of this study also proved that there was a significant relationship between teachers' self-efficacy on teachers' attitudes and awareness towards environment. According to Salim Rejab (1998), to inculcate a positive attitude and knowledge of environmental issues to students in advance, teachers should have knowledge and positive attitude towards these issues. Affective aspect is very important because the attitude of EE will determine the future of mankind and the quality of life on earth (Knapp, 1972). Ramsey & Rickson (1976) assert that attitudes are important for environmental policies that are reasonable. But the study done by Salim Rejab (1998), found that teachers with higher knowledge is not necessarily a positive attitude. The study done by Peyton and Hungerford (1978) also recognizes the increasing knowledge does not necessarily create a positive attitude. The findings found by Salim Rejab (1998), Peyton & Hungerford (1978) also supports the findings of this study in which the factors of teachers' knowledge about the environment do not show a significant relationship with teachers self-efficacy. Hungerford & Bryant (1977) also says the change in attitude towards environment of an individual from a young age and continue to grow, at which stage of adolescent and adult understanding of environmental issues become more significant.

The findings also show that the main predictors of teachers self-efficacy in implementation of EE is the teachers' awareness factor towards environment (B=.168), second predictor is teachers perception towards principals' instructional leadership practices for third dimensions: Climate Nurturing Teaching and Learning of EE (B=.116) and third predictor is teachers attitudes towards environment (B=.169). This situation showed that the higher level of teachers' awareness, the positive attitude shown by teachers towards environment and the higher level of school principal instructional leadership practices for the dimensions of Climate Nurturing Teaching and Learning of EE will increase the level of teacher self-efficacy in implementation of EE. Furthermore, the fourth predictor is teachers' perception towards school principal instructional leadership practices for the dimensions of Instructional Management Programs and Environmental Programs (B= -.071). This situation showed that an increased in principal instructional leadership for Instructional Management Programs and Environmental Programs will lead to the decrease teachers' self-efficacy level in implementation of EE. The fifth predictor is teachers age factor (B= -.008). This situation reflects that an increase of teachers' age will lead to the decrease of teachers' self-efficacy level towards in implementation of EE. Meanwhile, the lowest predictor is academic qualification factors (B=.120). Higher level of teachers' academic qualification will lead to higher level of their self-efficacy.

CONCLUSION

The study was conducted to identify factors that influence teachers' self-efficacy in implementation of EE in the states of Perlis, Selangor, Pahang, Melaka and Sarawak in Malaysia. Therefore, this study can only be generalized to teachers in five states involved with this study at the time research data was collected. The results of this study showed that the factors influencing teachers' self-efficacy in implementation of EE are teachers' awareness and attitude towards environment, teachers' perception towards school principal instructional leadership practices as well as teachers academic qualification and teachers' age.

Information derived from these thesis research findings will be a good source of information to Ministry of Education; in particular Curriculum Development Division and policy makers to take into account these factors in updating the curriculum and syllabus for EE. This is to ensure that EE can be truly implemented effectively and achieve the goals and objectives as set out in the Teachers' Guidebook of Environmental Education Cross Curriculum for KBSM, 1998. Therefore, the level of teachers' self-efficacy or the teachers' ability to teach EE should be given serious attention and should not be taken lightly. It is hoped that the information obtained from this study will help to enhance knowledge, cultivate awareness and intensify the involvement of principals, teachers and students in implementation of EE as a cross curriculum subjects. The findings of this study is also expected to help the District Education Office; Department of Education; Institute of Aminuddin Baki; Institute of Principalship Studies, University of Malaya; Institute of Malaysian Teachers Education and other organizations to provide exposure and knowledge of school administrators and teachers about the importance of preserving and conserving the environment by way of holding conventions, seminars, courses, workshops, camps

and lectures. Finally, this study hopes to contribute useful knowledge by enrich and expand the research in the field of EE in addition to help and to be a source of reference to others researchers in the near future.

REFERENCES

[1] Abdullah Ismail. (2001). *Persepsi guru terhadap kepemimpinan pengajaran pengetua-pengetua sekolah menengah daerah Temerloh dan Bera.* Unpublished Masters Thesis. Serdang: Universiti Putra Malaysia.

[2] Ahmad Salihin. (2004). *Persepsi guru terhadap modul ekosistem hutan bakau mengikut bidang mata pelajaran di sekolah-sekolah menengah daerah Tampin.* Unpublished Masters Project Paper. Serdang: Universiti Putra Malaysia.

[3] Bandura, A. (1986). *Social Foundations of Thought and Action.* Englewood Cliffs. NJ:Prentice Hall.

[4] Baharom Mohamad (1998). *Persepsi guru-guru terhadap kepemimpinan pengajaran pengetua sekolah harapan negara di negeri Johor: Satu Tinjauan*. Unpublished Masters Thesis. Skudai: Universiti Teknologi Malaysia.

[5] Basset, G. W., Crème, A. R. & Walker, W. G. (1974). *Headmaster For Better School.* St. Lucia: University Queensland Press.

[6] Blake, J. A. & Champion, D. J. (1976). *Method and Issues in Social Research*. New York: John Willey and Sons.

[7] Hallinger, P., & Murphy, J. (1985). Instructional leadership and school socio-economic status: A preliminary investigation. *Administrator's Notebook.* 31(5): 1-4.

[8] Hallinger, P., & Murphy, J. (1987). Assessing and developing principal instructional leadership. *Education Leadership.* 45(1): 54-62.

[9] Hipp, K.A. and Bredson, P.V. (1995). Exploring connections between teacher efficacy and principals' leadership behaviour. *Journal of School Leadership,* 5(2), 136-150.

[10] Hungerford, H.R dan Bryant D. (1977). An Analysis of Strategies for Teaching Environmental Concepts and Values Clarification in Kindergartens. *The Journal of Environmental Education*. 9: 44-49.

[11] Kementerian Pelajaran Malaysia. (1998). *Buku Panduan Guru Pendidikan Alam Sekitar Merentas Kurikulum KBSR dan KBSM,* Curricullum Development Divisions, MOE, Kuala Lumpur.

[12] Knapp, C.E. (1972). Attitudes and Values in Environmental Education*. Jurnal of Environmental Education.* 3(4). 26-29, Summ.

[13] Knapp, C. E. (1999). *In accord with nature: Helping students form an environmental ethic using outdoor experience and reflection*. West Virginia: ERIC. Clearinghouse on Rural Education and Small Schools.

[14] Krantz, P.D. (2002). *A study of the impact of environmental education workshops on teachers' attitude and efficacy*. Ph.D. Thesis, University of Missouri-Columbia. Umi ProQuest Digital Dissertations.

[15] Langenbach, M., Vaughn, C. & Aagaard, L. (1994*). An introduction to educational research*. Boston: Ally and Bacon.

[16] Mohd Majid Konting. (2005). *Kaedah Penyelidikan Pendidikan, Edisi Ketujuh.* Kuala Lumpur: Dewan Bahasa dan Pustaka.

[17] Munira Mohsin. (2000). *Persepsi guru terhadap amalan konsep kepimpinan pengajaran di kalangan pentadbir ke arah sekolah berkesan*. Unpublished Masters Thesis, Serdang*:* University of Putra Malaysia.

[18] Palmer, J.A. (1998). *Environmental education in the 21st century: Theory, practice, progress and promise.* New York: Routledge.

[19] Palmer, J dan Neal, P. (1994). *The handbook of environmental education*. London and New York: Routledge.

[20] Peter Songan, & Rijeng Jishet. (2000). Instructional leadership roler of secondary school in Sarawak. *Jurnal Pendidikan Universiti Teknologi Malaysia.* Oktober 2000. 6: 22-34.

[21] Peyton, R.B & Hungerford, H.R. (1978). An Assesment of Teachers Abilities to Identify, Teach and Implement Environmental Action Skills. *Current Issues on EE,* IV, Craig B. Davis & Arthur Sacks, Editor.

[22] Pudin, S., Tagi, K. & Periasamy, A. (2004). *Environmental education in Malaysia and Japan: a comparative assessment.* Available online at http://www.ceeindia.org/esf/download/paper20.pdf (accessed 3 January 2009).

[23] Ramsey, CE & Rickson, R.E. (1976). Environmental Knowledge and Attitudes. *Journal of Environmental Education ,* 8(3), 10-18.

[24] Salim Rejab. (1998). *Pengetahuan dan sikap guru-guru pelatih terhadap isu-isu alam sekitar*.Tesis Sarjana Pendidikan yang tidak diterbitkan. Kuala Lumpur: Universiti Malaya.

[25] Sia, A. P. (1992). *Preserves elementary teachers' perceived efficacy in teaching environmental education: A preliminary study. East Lansing, MI: National Centre for Research on Teacher Learning*. Paper presented at the ECO-ED North American Association for Environmental Education Annual Conference, Toronto, Canada, October 28, 1992. (ERIC Document Reproduction Service No.ED362487).

[26] Shafari Mohamed Nor. (2001). *Kajian Amalan Kepemimpinan Pengajaran Pengetua Dari Persepsi Pengetua dan Guru Sekolah Menengah Di Kuala Pilah.* Tesis Sarjana Sains yang tidak diterbitkan. Serdang: Universiti Putra Malaysia.

[27] Shahrom Sukari (1999). *Persepsi Guru-guru Terhadap Kepimpinan Pengajaran Pengetua Sepatut dan Sebenar Di Sebuah Sekolah Menengah Daerah Kulai.* Tesis Sarjana yang tidak diterbitkan. Skudai: Universiti Teknologi Malaysia.

[28] Sulaiman Ngah Razali. (1991). *Penggunaan statistik dalam penyelidikan pendidikan.* Kuala Lumpur: Dewan Bahasa dan Pustaka.

Implementation Sun Tzu's the Art of War by America in Afghanistan War

Wong Chooi Ye
Universiti Pertahanan Nasional Malaysia
*celeswongchooiye@yahoo.com

Abstract
In this paper, US had launched attack against Afghanistan back in 1921. There is criticism arguing that US attack after September 11, 2001 is simply vengeance. US success and failure in Afghanistan War to their adherence and violations to the Sun Tzu's Art of War are identified and analysed in this paper. Analysis is conducted based on articles, journals and books ranged from historical occurrence until present situation.

Keywords
Afghanistan War, colonized, The United States of America, terrorists, culture, terrain, the Sun Tzu's Art of War, the Soviet Union.

INTRODUCTION

The Islamic Republic of Afghanistan is a land-locked in South-Central Asia. It is bordered by Pakistan in the south and east, Iran in the west, Turkmenistan, Uzbekistan and Tajikistan in the north, and China in the far northeast. [1]

Afghanistan has never been colonized or captured throughout history since Empire of Alexander the Great. The culture is unique that Afghanistan is mostly a tribal society, [2] each region has their own separate tradition. The Afghans have honed martial skills by fighting among themselves, in terrain that facilitates divisions of power and resists the concept of centralized control since 2500 years ago [1]. Hence, battles between cultures or religions always take place.

Tribes in remote areas are special phenomena in Afghanistan. They are governed on a feudal basis. This is the major reason of why they have never been colonized. 'Afghan' means noisy, unruly and less than sedate as those mountains are populated by hermits or pacifists [2].

Afghan ethnic group included Pashtuns, Turks (Uzbeks, Tajiks, Turkmen), mongoloid Hazaras, redheaded Nuristanis, brown-skinned Brahui, and a number of other groups [3].

PROMBLEM STATEMENT

It is necessary for the author to explore the implementation of Sun Tzu's the Art of War by America in Afghanistan War. However, this paper will try to answer the following problems:

- Why is it so difficult to achieve peace in Afghanistan?
- What are the current policies of the United States?
- What are the problems of the United States' military strategies against Afghanistan?
- US and NATO strategy appears to shift from the employment military fire power to other 'softer approach'. The question is, is the soft approach effective in order to solve the problems?
- Are the United States of America and its coalition able to disentangle the Afghanistan conflicts?

REVIEW OF LITERATURE

Afghanistan was first invaded by Alexander the Great and his Marcedonian troops in the 4th century. [3] The Mauryan Empire of India emerged in 305 BC and was given the power to control southern Afghanistan. [4] Arab Muslims began a 100-year of conquering Afghan tribes and introducing Islam in 637. In 1220, Central Asia fell into Mongol empire of Genghis Khan.

Ahmad Shah, known as the founder of the Afghanistan nation,[5] united the Pashtun tribes and by 1760 built an empire extending to Delhi and the Arabian Sea [4].

---

[1] http://en.wikipedia.org/wiki/Afghanistan

[2] According to CIA World Factbook, September 15, 2010, ethnic groups in Afghanistan consist of Pashtun 42%, Tajik 27%, Hazara 9%, Uzbek 9%, Aimak 4%, Turkmen 3%, Baloch 2%, other 4%.

[3] Afghanistan was totally devastated as the empire passing through to defeat Darius III of the Persia. After 1000 year of Mercedonian conquest, the light was brighten up again as Islam spread across Afghanistan.

[4] Mauryan was succeeded by his son, Bindusara. In 268 BC, Bindusara's son, Asoka assumed he throne and continued conquering new territory. But he converted to Buddhism.

[5] He was chosen as the leader of Durranis in *jirga* or a council in 1747. This incident marked the birth of the Afghan nation. Unfortunately, Afghanistan was disintegrated after his death in 1772. Afghanistan was still a coalition of tribes than a nation.

According to Stephan Tanner(2009), Afghanistan was unique for three factors: [6]

- Its terrain facilitated the ability if tribes to exist independently among inaccessible mountains. Terrain presented no such difficulties for tribes to descend from their heights to participate in collective defense.
- The country in the midst of an already degraded south-central Asia, had became increasingly isolated from the main currents of global commerce and thus the main paths of foreign armies.
- Afghanistan was in a land where indigenous strength lay with the nomad population rather than in the sedentary communities that had been repeatedly ravaged across centuries of warfare, the very primitiveness of the Afghans counted toward their formidability. They remained a warrior people with a martial ethnic – entirely willing to fight among themselves when not otherwise challenged.

Therefore, the Afghan became fearsome to the other civilization.

Dost Mohammad ruled at the beginning of the Great Game in 1813, a century-long contest for domination of Central Asia and Afghanistan between the Soviet Union and British. [7] British intervention in Afghanistan administration and insurgency by the Afghan tribesmen triggered the First Anglo-Afghan War in 1839[8]. British invaded in 1878 and held Afghanistan in the Second Anglo-Afghan War. [9] The Durrand Line is secured by the British in 1893, dividing Afghanistan from British colonial territory of India.

Afghanistan signed the Treaty of Rawalpindi in 1919, which ended the Third Anglo-Afghan War and marks Afghanistan's official date of independence.

The long-standing division of the Pashtun tribes caused tension with the neighboring state of Pakistan, founded on the other side of the Durand Line in 1948. In response, Afghanistan shifted its foreign policy toward the Soviet Union. [10] Mohammad Doud (1953-1963) modernized and centralized Afghan government, but was dismissed by Zahir Shah of his anti-Pakistani policy. Doud overthrew the king in 1973, but he was superseded by the communist faction in 1978 because of the unimproved economic conditions.

The Soviet War in Afghanistan burst in 1979 under Soviet's leader Leonid Brezhnez, after the tribal insurgency against the communist government. Between 1979 and 1989, two Soviet-sponsored regimes failed to defeat the federation of mujahideen guerrillas that opposed the occupation. After 10 years of prolong warfare, Soviet announced to withdraw its forces from the battlefield of Afghanistan.

The civil war between the Afghan government and the mujahideen continued after the Soviet withdrawal in 1988 [5]. The 1988 agreement did not settle differences between the Northern Alliance and the mujahideen, and in 1992 Afghanistan descended into a civil war that further ravaged the economy. Among the leaders of the warring factions were Ahmad Shah Massoud, an ethnic Tajik; Gulbuddin Hekmatyar, a Pashtun; and Abdul Rashid Dostum, and Uzbek.

The Taliban, an Islamic fundamentalist group gained control of most of the country in 1996. The Taliban asserted repressive control of society by adopting an extremist interpretation of Islam. [6] The Taliban granted the Arab terrorist organization al-Qaeda the right to use Afghanistan as a base. Al-Qaeda committed a series of international terrorist acts culminating in attacks on the US on September 11, 2001. Despite of international pressure, the Taliban refused to surrender al-Qaeda leader Osama bin Laden. When the US and allies attacked Afghanistan in 2001, the Taliban government collapsed. Nevertheless, the Taliban and al- Qaeda leaders escaped. A US–led International Security Assistance Force (ISAF) began an anti-terrorism warfare until present. There is criticism that US attack of Afghanistan is completely unjustified. [7]

Sun Tzu's the Art of War

There are 13 chapters in Sun Tzu's the Art of War, included Estimation, Waging War, Offensive Strategy, Dispositions, Posture of Army, Void and Actuality, Maneuvering, The Nine Variables, On The March, Terrain, The Nine Varieties of Ground, Fire Attack as well as Use of Spies. [8]

This extended abstract is not accomplished considering the author is still pursuing the first year of the masters programme. Therefore, currents issues, finding and conclusion are not generated yet.

OBJECTIVES

The main objectives of the research are:

- To identify the actions taken by the US in the conduct of war in Afghanistan.
- To analyse Sun Tzu's Art of War and the principles of War that it expounds.
- To link the US actions in Afghanistan of their success and failures, to their adherence or violations to Sun Tzu's Art of War.

---

[6] A military historian.

[7] Afghanistan played a role as the "crossroad of Asia" by the 1830s with the establishment of the East India Company.

[3] http://en.wikipedia.org/wiki/First_Anglo-Afghan_War

[9] http://en.wikipedia.org/wiki/Second_Anglo-Afghan_War

[10] http://lcweb2.loc.gov/frd/cs/profiles/Afghanistan.pdf

METHODS

The methods applied in the research are:

- Identifying US actions in Afghanistan and linking them to Sun Tzu's the Art of War.
- It will involve data collecting and analysing the activities of US forces in Afghanistan since 1921. Sources included newspapers, journals and news magazines.
- Reading up and analyzing Sun Tzu's Art of War. Sources included various books and interpretation on Sun Tzu's Art of War.
- Analysing how Sun Tzu's Art of War has been adhered to or violated by the US in the War in Afghanistan.
- Suggesting what could have been done by the US in terms of the adoption of Sun Tzu's Art of War in their campaign in Afghanistan.

ACKNOWLEDGMENTS

I wish to express my highest gratitude to Lt. Col. (R) Prof. Madya Ahmad Ghazali and Dr. Radziah binti Abdul Rahim, my supervisors for their precious advice, guidance and motivation. I also thank the Centre for Research and Postgraduate Management for their assistance and suggestions, especially Prof. Dr. Hjh. Fatimah, Madam Julia and Madam Juriah. I also acknowledge supports of my fellow friends of the University and family.

REFERENCES

[1] Tanner, Stephen, *Afghanistan: A Military History from Alexander the Great to the War against the Taliban.* Da Capo Press, Massachusetts (2009).

[2] Tanner, Stephen, *Afghanistan: A Military History from Alexander the Great to the War against the Taliban.* Da Capo Press, Massachusetts (2009).

[3] Central Intelligence Agency (CIA) World Factbook (2010).

[4] Library of Congress – Federal Research Division, *Country Profile: Afghanistan* (2008).

[5] http://en.wikipedia.org/wiki/Afghan_Civil_War_ (1978-present)

[6] Meissner, Ursula, *Afghanistan: Hope and Beuty in a War Torn Land.* Bucher, Germany (2008).

[7] Roy, Arundhati, "A US Attack on Afghanistan is Simply Vengeance", *The US Attack on Afghanistan.* Greenhaven Press, Detroit (2005).

[8] Tao Hanzhang, General, *Sun Tzu's Art of War: The Modern Chinese Interpretation.* Sterling Innovation, New York (2000).

Problems of Private Residential Property Development in Makama Jahun Neighbourhood Of Bauchi Metropolis, Nigeria

Aliyu Ahmad Aliyu, Rozilah Kasim (PhD) and David Martin (PhD)
Faculty of Technology Management, Business and Entrepreneurships
Universiti Tun Hussein Onn Malaysia, 86400, Parit Raja, Batu Pahat,
Darul Ta'zim, Johor, Malaysia
e-mail: aaaliyu1978@yahoo.com, rozilah@uthm.edu.my, martin@uthm.edu.my

Abstract
This study was designed to investigate and examine the problems encountered by private residential property developers in developing their residential accommodation in Makama Jahun neighbourhood of Bauchi Metropolis Two hundred respondents were selected through stratified random sampling. Data were presented using simple percentage distribution tables and complete theoretical analyses were used to analyze data that are not numerical in nature. The analysis revealed that high cost of building materials, non-use of local building materials, low income of the majority of the respondents and poor source finance amongst others were discovered to be the major constraints to residential property development in the study area. Others are problem of land acquisition and statutory regulation which were also among the obstacles faced by the respondents. In other to make a meaningful and adequate coverage the study is limited to Makama Jahun area of Bauchi metropolis. This paper represents the first work that analyse the problems of rivate residential property development in MakamaJjahun neighbourhood of Bauchi metropolis, Nigeria. To arrest this situation, the use of local building materials should be encouraged by the respondents. Financial institutions should scale down on their stringent lending requirements for a building loan. The chains of schedule in formal land acquisition should be reduced by the government and thereby quicken acquisition process. If these are followed, it will help to combat residential development problems identified in the study area and other similar blighter neighbourhoods

Keywords
Housing Problem, Neighbourhood, Nigeria, Private residential property, Property Development

INTRODUCTION

One of the greatest problems in the world today is that of provision of shelter. Shelter must not be only adequate for the population but also habitable. This problem is more pronounced in the urban areas where population pressure is on the increase. The problem of looking for shelter leads to invasion of land for the purpose of building (Jinadu, 2008)

In Nigeria, the urban housing situation continues to deteriorate in the absence of an adequate arrangements to ensure that housing facilities expanded in line with the rapidly population growth. Despite the past efforts of the nations housing problem, it was evident that the combined effort of the public and private sectors over the past successive government plans had continued to fall far short of housing need (Agbola, 2007). Past governments had tended to leave this important sector almost entirely to private effort, concentrating itself on the provision of limited number of residential quarters for its deserving officers. Abdul (2008) noted that the major symptoms of urban housing problems include:-

(i) An absolute shortage of housing units.
(ii) The emergence and proliferation of slums and squatter settlement especially in large cities.
(iii) Rising house rents; and
(iv) A growing inability of citizens to buy or build their own houses.

Individual effort to build or own a residence becomes quits difficult by the majority of the people subject to number of constraints. As a matter of fact the quality of life in any given environment is greatly influenced by the nature and standard of built up structures particularly residential properties. Agbola (2009). A cursory look at past housing policies and programmes in Nigeria reveals that effective solutions to housing problems in general and low income housing in particular are yet to be found. The housing situation has deteriorated continuously due to rapid natural population growth, increasing rural-urban migration etc. It is now generally agreed that most Nigerian states are facing a housing "crisis" of major proportion and a bounteous number of statistics and studies are available supporting this view (Abiodun 2008).

It is evident in Nigeria that in most cases objectives designed for a particular project are hardly ever realised. This is especially so when a critical look is made of the various government housing policies. For instance, Liman (2007) assessed the effectiveness of public low income housing programme in metropolitan Kano, which showed that the overall contribution of the programme in terms of increasing the supply of new housing required in metropolitan Kano was 50% of the planned target of 77,852 housing units for the

period between 1975 and 1980. In addition, the low income group for whom the programme was meant did not constitute a substantial proportion of the eventual beneficiaries.

RESEARCH METHODOLOGY

The entire layout (Makama Jahun area) was stratified into eighteen clusters by the Ministry of Land and Survey, Bauchi. The number of plots vary from one cluster to another, the largest being S: 13 with a total of 262 plots while cluster S: 14 has the least number with 13 plots. Each cluster represents a stratum that can be studied independently from others. Having stratified the layout, 10% of the plots i.e partially developed and undeveloped plots from each cluster were selected randomly using the table of random digits.(see table 1 below)

This is necessary to achieve a reasonable spread in the location of interviews and questionnaires to be able to obtain a cross-section of problems experienced in the development process in different parts of the study area. This is imperative because of local variations in problems. The table below shows the layout of the Makama Jahun Neighbourhood.

Table 1: Makama Jahun Layout

S/NO	Layout Number	Total Number of plots	Number of Fully Developed Plots	Number of Partially Developed Plots	Number of Undeveloped Plots
1	S:1	116	15	65	36
2	S:2	80	7	40	33
3	S:3	83	9	44	30
4	S:4	104	12	61	31
5	S:5	144	14	82	48
6	S:6	114	11	74	29
7	S:7	283	21	185	77
8	S:8	15	2	8	5
9	S:9	90	9	47	34
10	S:10	55	5	28	22
11	S:11	198	18	118	62
12	S:12	132	15	67	50
13	S:13	120	12	62	46
14	S:14	159	16	87	56
15	S:15	238	28	153	57
16	S:16	155	18	77	60
17	S:17	28	3	15	10
18	S:18	157	17	87	53
Total		2271	232	1300	739

Source: Field Survey (2010)

From the table above, it can be deduced that, the total number of partially and undeveloped plots are more than the developed ones. This, therefore, necessitate investigation to find out the reason why the property developers are unable to complete their houses. The research is only interested in partially and undeveloped plots. The table below, therefore, shows percentage samples drawn from each layout

Table 2: Ten Percent Samples Drawn from Each Layout

S/NO	Layout (Cluster) Number	Total number of plots (partially and undeveloped plots)	Samples Drawn
1	S:1	101	10
2	S:2	73	7
3	S:3	74	7
4	S:4	92	9
5	S:5	130	13
6	S:6	103	10
7	S:7	262	26
8	S:8	13	1
9	S:9	81	8
10	S:10	50	5
11	S:11	180	18
12	S:12	117	11
13	S:13	108	10
14	S:14	143	14
15	S:15	210	21
16	S:16	137	13
17	S:17	25	3
18	S:18	140	14
Total		2039	200

Source: Field Survey (2010)

In all, a total of 200 plot allotees representing about 10% of the total number of plots (2033) on the area were selected and administered with the questionnaires. Two types of questionnaires were administered. The first one was administered to the property developers in the study area. The second one was administered to Federal Mortgage Bank of Nigeria Bauchi Branch.

The content and scope of the questionnaires are broad. For the property developers, it touches on socio-economic characteristics of the respondents their source of finance, problems encountered during land acquisition etc. For the Mortgage Bank it touch on the procedures for the issuance of the loan, interest rate chargeable, class of people that the Bank gives loan for private residential property development and classes of people that benefited from the Bank loan scheme among others.

Interviews were held with the head of planning unit of Bauchi State Urban Development Board, practicing estate surveyors and valuers, land officers, private developers, builders etc on information about building regulations, planning standards, etc. To have sufficient ground of balancing these observations, legal practitioners were also contacted using the same unstructured interview pattern. The aim of this was to find out the frequency at which they handle land-related cases in the study area, especially as it relate residential land and how these cases are finally resolved.

RESEARCH FINDINGS

Duration of Plot Acquisition Process by the Respondents

Though there is no official guidelines as regard how long land acquisition for residential purposes should take; it is expected that a minimum delay is associated with land transaction, especially for residential needs. This is because acquisition of land is the basis upon which all land use rest. Table 3 below is an analysis of duration experienced by respondents before they could get their titles registered in case of the formal plot allotees.

Table 3: Time Taken to Acquire Registered Plots by the Respondents

Time Taken	Number of Respondents	% Frequency
1-3 Months	14	7
3-6 Months	48	24
6-12 Months	64	32
After one year	74	37
Total	200	100

Source: Field Survey (2010)

From table 3 above, it is evidenced that in the study area, the official plot allotees could not finally document their land acquisition formalities until after about one year (37%). This period is indeed frustrating to so many people wishing to acquire land for residential purposes. The duration that is considered by many respondents as reasonable is the period between one to three months and as it can be seen from the table, this is represented by a small percentage (14%). Greater respondents in the study area were not able to register their land between three to six months and six months to one year of application. Other findings revealed that those plot owners that were able to register their titles between 1-3 months had either used the influence of their position or wealth.

Observations have shown that because of the individual interest, sentiments and values attached to the land in the study area, acquisition for public and private purposes has always been difficult, protracted and frustrating affair which is worth mentioning here. It is because of this, in addition to the earlier reasons that land transaction in the study area become problematic and cumbersome. Furthermore it is because of these reasons that land transaction has to vary considerably from place to place. The attractive quality of a place where plot is situated could also influence the speed of registering such titles.

Difficulties Experienced by Respondents in the Study Area

Land acquisition process in the state start by filling the prescribed application form, processing the application and registering of the title as already observed in this write up. The process is not without its difficulties, and these are differently experienced by plot owners in the study area. These difficulties range from high fees to staff attitude. (See table 4 below)

Table 4: Difficulties Experienced by Respondents in the Study Area

Difficulties	Number of Respondents	% Frequency
Deposit fee	19	9.5
Processing fee	11	5.5
Reproduction of building plan	53	26.5
Reproduction of deeds	7	3.5
Conversion process	29	14.5
Staff attitude	17	8.5
All of the above	64	32
Total	200	100

Source: Field Survey (2010)

Table 4 above showed that in Makama Jahun area, the entire respondents experienced problem at all levels; the greatest problem experienced by these respondents was production of building plans. Though, they had already acquired the land, they maintained that it was one of the stages that delayed the regulation of their plot. 5.5% of the respondents in the study area experienced the difficulty of processing fee; this is the fee that plot allotees have to settle in survey, town planning and land division before registering their titles. 8.5% however, suffered the problem that emanate from staff attitude. This is the attitude of staff in the three units of lands, survey and town planning.
This staff attitude manifest itself in the way and manners staffs deliberately delay acquisition of land in order to frustrate the efforts of applicants. This was discovered to be reasons why many respondents could not carry their land acquisition process to an end; in the contrary they often stopped at the level of issuing a grant right. In the same vein, 14.5% encountered difficulties of conversion process; this is the process of regularising lands that had earlier on, been given or acquired through the procedure of either ward head or local governments. 3.5% of the respondents in the study area faced problem of deed registration in land department.

The nature of the building plan problem is in the number applicants are required to include in their application files. A minimum of eight building plans, according to many respondents are too much for residential purposes and consequently delay land acquisition process, more so that they are often rejected on the ground of non-conformity with the planning regulations.

Degree to which Various Procedures are Exploited in Land Acquisition

The table below shows the various procedures used by the respondents to acquire land in the study area.

Table 5: Analysis of various Procedures for Land Acquisition

S/N	Various Procedures of Land Acquisition	Number of Respondents	% Frequency
1	Through informal acquisition	63	31.5
2	Through local government	19	9.5
3	Through sale	51	25.5
4	Through wardhead	21	10.5
5	Through gift	7	3.5
6	Through inheritance	13	6.5
7	Through lease	8	4
8	Through sublease	12	6
9	Through pledge	6	3
	Total	200	100

Source: Field Survey (2010)

Above finding revealed that the most used procedure is through informal acquisition in the study area. This is

followed by those who acquired their land through sale; that is, people acquired their land through purchase from hoarders. The least used procedure in land acquisition is that of gift. The procedure of sublease is fairly used too.

Now that the procedure of informal acquisition is seen to be dominant among all the rest method, the degree to which this method is properly observed becomes problematic because of the high prices charged by the land speculators. Most of the respondents who acquired their land through sublease indicated that the official consent process has not been formalised. This is a negation of the section 21 and 22 of the 1978 land use decree.

General Assessment of Land Acquisition Process by Respondents

To assess a phenomenon of this kind, there is bound to be varying opinion since it is not possible to have the same acquisitioned experience. Parameters of simple, very simple, fair, difficult and very difficult is therefore adopted for easy reference point of assessment.

Table 6: Assessment of Residential Land Acquisition Process by the Property Developers

Assessment Formula	Number of Respondents	% Frequency
Very simple	2	1
Simple	3	1.5
Fair	21	10.5
Difficult	82	41
Very difficult	92	46
Total	200	100

Source: Field Survey (2010)

From the above table almost half of the respondents e assessed the general land acquisition process to be very difficult (92%). This is followed by those respondents who assessed the process as difficult (82%). Putting these together, there are many respondents in the study area whose experience in land acquisition is not favourable. On the whole, therefore, majority of respondents in the study area had assessed land acquisition process to be either difficult or very difficult. This is a great obstacle to residential property development in the study area.

Due to urbanisation, many people are moving from the rural to the urban areas where modern facilities are available; population pressure in cities and towns had made residential accommodation in particular a problem. Furthermore, the congested urban places are in need of expansion, but land where this expansion is to be made is scarce. Land has become of great marketable value and no longer the ordinary land known to African tradition as a gift of nature to mankind. This observation has probably acted as a catalyst to the promulgation of the 1978 Land Use Decree to have a unified system of land acquisition and most importantly to reduce the activities of land speculators. This, from policy view, should have taken care of all or at least some of the irregularities in urban land acquisition.

The involvement of ward heads in land transaction in the study area have been established through this finding to be due to lack of adequate settling of the affected people through compensation, and even where compensation issues is adequately addressed, they are still found in land transactions in the study area.

Duration in Formal Land Acquisition

As shown in the table below, the time taken for a respondent to acquire plot for residential development is frustrating and more than the stipulated time.

Table 7: Time Taken in Formal Land Acquisition

Period Taken	Number of Respondents	% Frequency
1-3 months	1	0.5
3-6 months	7	3.5
6-12 months	14	7
After one year	178	89
Total	200	100

Source: Field Survey (2010)

It can be seen here that most respondents generally acquired their land with difficulties in the formal method. This picture is more conspicuously revealed looking at the table critically. 89% of the respondents acquired their land after one year. Invariably, therefore, people will continue to prefer other method of land acquisition not mindings the high financial involvement but for its fast nature.

Reason for Acquiring Land Informally

The delay and uncertainties that is associated with government official procedures of land acquisition has been the general reason for people opting for other alternatives of land acquisition. Investigation had discovered that there are other specific reasons which range from being cheap, easy to costly depending on the source.

Table 8: Reasons for Informal Land Acquisition

Reasons	Number of respondents	% frequency
Easy, cheap and fast	11	5.5
Easy, costly but fast	40	20
Cheap and fast only	4	2
Easy and fast only	10	5
Easy and cheap only	9	4.5
Costly and fast only	126	63
Total	200	100

Source: Field Survey (2010)

The table showed that the respondents who gave reasons of costly and fast (i.e 63%) are the highest in the study area. Representation of other reasons is indeed small, and this as the findings showed is in respect of lands that are acquired through warhead, inheritance and alienation among others. In the same vein, those respondents who gave reasons of costly and fast are those plot owners who acquired them through either vendors or land speculators as revealed through this research.

This research had discovered that the amount involved in this informal land acquisition is several times higher than what is involved in the government official procedure. The only advantage which the formal acquisition procedure has over this is that of legality. This however is not a threat to the patronisers of informal process. It is in the light of the above observations that James (2001) was quick to conclude that accumulation of lands by speculators who are protected by the law indirectly hinders acquisition of lands by individuals and public agencies for execution of development plans.

Cost of Building Materials

Building materials normally are over half of the total cost of a building. The period since the mid 1990s has witnessed an increasing upsurge in the cost of construction materials. The property developers in the study area face high cost of building materials caused by the unprecedented inflation rates in the economy. Even as far back as 1987 when prices were relatively lower, unless one had a "five digit" savings, he could not think of embarking on a building project. This is purely because of the high cost of construction materials. For example, the rising cost of building materials based on market survey of some materials is on the table below.

Table 9: Prices of Some Building Materials from 2008-2009 in Muda Lawal Market Bauchi

Materials/Item	Brand	Quantity	Building Materials Prices as at January, 2008 (N)	Building Materials Price as at December, 2009 (N)
CEMENT	Portland	Per 50kg	1,600	1,800
Sandcrete block	9 inch	bag	70	90
Sandcrete block	6 inch	Per 1	50	60
Gravel	Aggregate	Per 1	1,200	1,500
Sharp	Sand	Per tipper	7,000	8,000
Laterite	Sand	Per tipper	6,000	6,000
REINFORCEMENT				
Rods	Smooth	Per price	2000	2,500
16mm	Smooth	Per price	1,000	1,200
12mm	Smooth	Per price	1500	2000
13mm				
DOORS				
Plush doors	Big/small	Per 1	2,600	3,000
Wood doors	Big	Per 1	9,000	12,000
Wood doors	Small	Per 1	7,000	10,000
Iron doors	Big	Per 1	20,000	22,000
Iron doors	small	Per 1	12,000	13,000
TILES				
Ceramic tiles	Ceramic 6 x 6 wall tiles	72 pieces	600	800
	8x8per square		800	1,000
P.V.C. Tiles	Rubber tiles	Per carton	10,000	12,000
FITTINGS				
Wash hand basin	Abeokuta product	Per 1	7,000	8,000
	England	Per 1	8,000	10,000
Wash hand basin	Aristone	Per 1	6,000	7,000
	Aristone	Per 1	16,500	18,000
Bath tub	Abeokuta	Per 1	7,000	8,000
Water heater	England	Per 1	10,000	12,000
Water closet	With		4,000	5,000
Standard shower	Mixer		6,000	7,000
Shower tray	Deep type		6,500	8,000
	Fat type			
ROOFING SHEET	Swan Zinc	Per Bundle	8,500	10,000
	Star Zinc	"	9,000	10,500
	Hand Print	"	8,500	10,000
	Elephant		9,000	11,000
GLASS WORK				
Louvre Blades	4 blades	Per pair	400	500
	6 blades	Per pair	550	650
	8 blades	Per pair	750	900
	2 ft plain	Per pair	100	200
	2 ft tinted	Per pair	150	250
	3 ft plain		180	300
	3 ft tinted		200	350
PAINTINGS				
Emulsion paint	Saclux coloured	Per 4 lit tin	500	600
Gloss oil paint	Saclux coloured	Per 4 lit tin	2,000	2,300
WOODS				
Planks	Soft 2 x 3 x 12	Per 1	950	1,100
	Hard 2 x 3 x 12	Per 1	1,100	1,300

Source: Market Survey (2010)

The frequent increase in prices of building materials constitute a factor affecting housing development since developers cannot afford the high quality materials due to exorbitant rates. Therefore, the research work revealed that prices of building materials rise up continuously. The market survey as at 2009 on building materials shows the instability in prices of building materials.

It was also established through this study that masons charge ₦ 50 per single block laying and labourers were paid from ₦ 600 to ₦ 700 per day. The carpenters charge between ₦ 1,500- ₦ 1,700 for fixing windows and doors frames in addition to their actual prices of ₦ 1,200 and ₦ 1,300 and an averagely build cement toilet cost not less than ₦ 100,000. Electricity fittings, wall decoration (paints) and bugler proof fixtures will be necessary for a house to meet urban standard. This will not cost less than ₦ 300,000 for a 2 bedroom house. A conservative estimate by 2 building technology experts revealed that for a 2 bedroom core unit house to reach its occupancy stage, it will require the sum of ₦ 800,000 to ₦1,000,000,000.00.

State of Development and Rent in the study area

A larger proportion of the respondents (57.3%) are still constructing their residential accommodation 32.5% have not even started developing their plots. While 10.2% have completed their residential accommodation (See table 1). In the study area, monthly rent ranged between N 2,000 to 3,000 for a single room (normally very small- $6m^2$). But in cases of self contained flats- a 3- modern bedroom flat cost between N 140,000 to N 200,000 per annum. These high rentals are reflective of the shortage of housing accommodation. In some cases a self contained room

and parlor was being rented at N 230,000 per year while a 2-bedroom self- contained flat was N 250,000.

CONCLUSION AND RECOMMENDATIONS

This research work has attempted a description and explanation of the problems of private residential property development in Makama Jahun neighbourhood of Bauchi metropolis. Through the study carried out, it was realised that among the most important or prevailing problems affecting private residential property development in the study area include:- Problem of land acquisition, housing finance, building materials, statutory regulation among others.

Land virtually remains a factor negatively affecting housing development in the study area due to incessant failure of developers to get title to land. The long period of awaiting Right of Occupancy (R of O) and Certificate of Occupancy (C of O) is an outstanding obstacle to residential property development in the study area.The payment of numerous fees by developers at various stages of preparation of the legal document discourages developers to continue with the struggle for land acquisition. Eventually, some of the respondents resort to informal way of land acquisition which is financially cumbersome.

The activities of hoarders also discourage land development in the study area. The landowners that are not capable of developing them are not willing to sell their lands to the potential developers because they want to sell it at an exorbitant price. . The remaining available land for sale attracts high price. This excessive rate shorts up development costs. High cost of building materials has been identified as one of the major problems militating against adequate residential property development in the study area. Generally, the problems have included that of scarcity and high cost of imported building materials or those with foreign components.

In the study area, most developers do travel out to buy building materials in bulk to enable them realise some discounts as there is no building materials industry in Bauchi apart from asbestos roofing sheet industry. As earlier mentioned, this is due to the inflationary pressure in the economy which contributed excessively to the present rise in the cost of building materials, most especially when the building materials are imported.

Unless these problems are taken as challenges or are addressed promptly in the study area, the problem of residential property development in Makama area is likely to remain for sometime. Indeed, without the total commitment and involvement of both private and public sector, there will be no long lasting solution to the identified problems. Thus, while trying to provide a long lasting solution to the problems in the study area, it is advised and hope that those involved in the provision of residential accommodation would look at it as a challenge as well as race that is fast moving ahead of time in the study area. For the purpose of overcoming the problems of private residential property development in Makama Jahun area, the following recommendations and suggestions are made:-

1) There is a need to reduce the level of bureaucracy associated with land acquisition and thereby quicken acquisition process in the study area. It is necessary to reduce the chain of schedule in formal land acquisition. This will go a long way to facilitate efficient residential property development in the study area. This may not however be possible until when land officers are exposed to broad training on simple map interpretations in cadastral surveying. This can enable them to confirm space under application, instead of forwarding that to survey department. Survey department can however continue with its traditional function of charting the layout and monitoring of such charts too.

2). For effective and efficient land acquisition to be put in place in the study area, there is the need to revisit the issue of land fees charged currently and the basis of determination, especially in respect of residential need. The fixing of land fees by the state chief executive should rather be handled by a special committee that should be made up of professionals in land- related disciplines. This is necessary because most of the state chief executives who are mandated by the land use decree to fix land charges are not all professionals and therefore lack the professional skill with which to assess land values.

3). The use of local building materials should be encouraged by the government. The property developers should on their own use such building materials in the construction of their houses to demonstrate to the society that they are functional and durable. Also the government should grant subsidy to the industries manufacturing such local building materials until the society develops enough taste for such product to stimulate substantial demand.

4). Emphasis should be on functional design with economy of material uppermost by the property developers in the study area. Design type obviously has a direct effect on development cost, the realities of our time does not give any room for flamboyancy in design if we actually appreciate the meaning of residential property.

(5) Enforcing penalty for none development of allocated plots:- This measures will be taken in order to reduce the problem of land speculation which is one of the important factors explaining the delay in the development of residential plots in the study area. Government should enforce a strict compliance with the conditions stated in the allocation paper. Where allottee fails to effect development on his plot after five years, the title to such land should be revoked. This measure becomes necessary because the two years development, period is too short considering the present economic condition of the country, and the rate

at which the plots are left undeveloped in different residential layouts within the metropolis.

(6). Delay in disposing urban land: - The Government should avoid unnecessary delay in disposing urban residential land to genuine developers. In order to implement this effectively, right measures have to be taken in allocating the residential plots to most deserving applicants not to those who use the avenue as opportunity for making fortune. In addition to this, government and other financial institutions, should introduce and give out soft loan to developers, to facilitate plot development, particularly, the low income these groups. To implement this successfully loan should be inform of some building materials, such as cements roofing sheet etc.

ACKNOWLEDGMENTS

The researcher wants to humbly and sincerely appreciate the assistance and kind gesture of his main and co-supervisor Dr. Rozilah Binti Kasim and Dr. David Martin respectively for their untiring constructive criticism, suggestions, observations and guidance. Special thanks also goes to my research colleagues, department heads, and University Tun Hussein Onn Malaysia who sponsored this research. I say a big thanks to all of you.

REFERENCES

[1] Abdul, A.A. (2008). Time Lag in the Development of Urban Residential Plots in Kano Metropolis. An Unpublished M.Sc. Thesis, Geography Department, Bayero University Kano.

[2] Abiodun. J. (2008*). Housing Problems in Nigerian Cities*. National Institute of Social and Economic Research (NISER). Intec Printers, Ibadan.

[3] Abraham, C. (2006). *Man's Struggle for Shelter in an Urbanising World*. Massachusetts Institute of Technology Press, U.S.A.

[4] Adamu, E.O. (2007). The Private Development of Residential Land Subject to Statutory Title in Makurdi, Benue State, Nigeria. Unpublished M. Sc Thesis. Bayero University, Kano.

[5] Adebayo, A. and Rowling, L. (2007). *Management Problems of Rapid Urbanisation in Nigeria.* University of Ife Press, Ile –Ife, Nigeria.

[6] Ademola, T.S. (2006). *Nigeria's Housing Policies and Programmes*: *A Preliminary Assessments.* Butgers University, U.S.A.

[7] Adeniyi, E.O. (2008) *Challenges of Provision of Housing in Nigeria's Urban Centres*. Third International Conference on Housing. Years of Housing Development in Africa: Paper 1CH/12 Kaduna.

[8] Adeniyi, E.O. (2007). *Housing and the Construction Industry in Nigeria*, Nigerian Institute of Social and Economic Research (NISER) Intec Printers, Ibadan

[9] Agbola, T. Alabi, O. (2007). *Major Problems of Housing in Nigeria* .A Paper resented at the Workshop on Housing Organised by Bobabin Nig. Ltd, Held at Grennspring Hotel, Ibadan.

[10] Agbola, T. (2009). *Projection of Urban Housing Needs* NISER, Ibadan.

[11] Bourne, L.S. (2007) *A Geography of Housing.* Edward Arnold, London

[12] Bowyer, J. (2008) *Building Technology.* The Butterwort Group, United Kingdom

[13] Chatterjee, E. (2008) *Urbanisation Trends and Problems of Urban* Housing in Nigeria. Ibadan University Press, Ibadan.

[14] Clois, E.K. and Joan, C.K. (2009) *Residential Housing.* The Goodheart Willcox Company, Inc. South Holland Illinois.

[15] Dwyer, D.J. (2005) *People and Housing in Third World Cities*. Longman Group Limited, London.

[16] Egunjobi, L. (2007) *Housing Affordability and the Nigerian Poor.* A Paper Presented at the Staff/Postgraduate Students Seminar 1997/1998 Session, Geography Department, University of Ibadan, Ibadan.

[17] Gilbert, A. (2007) The Housing of the Poor. In Gilbert A. and Gugler J. (ed) *Cities, Poverty and Development: Urbanisation in the Third World*. Oxford University Press.

[18] Jinadu, A.M. (2008) *Understanding the Basic Issues of Housing*. Federal University of Technology Minna Press. Minna

[19] John, R.J. (2009) *Land Values, Housing Prices and Housing Shortages: A Geographical Perspective.* In Lonegrams, D.A. and Palre, R (eds). An Invitation to Geography. Cambridge University Press, United Kingdom.

[20] Josephine, O.A. (2008) *The Provision of Housing and Urban Environment Problems in Nigeria.* In Josephine, O.A (ed), Urban and Regional Problems in Nigeria. University of Ife Press Ltd, Ile-Ife Nigeria.

[21] Liman, M. A. (2007) Low- Cost Housing system for the Urban Poor. In Fahd, D.D. (ed), *Housing Problems in Developing Countries.* John Wiley and Sons New York.

[22] Lawal, M.I. (2000) *Principle and Practice of Housing Management. Environmental Design and Management Series.* ILCO Books and Publishers Taofik (Nig.) Ltd, Lagos.

[23] Sintia, I.B. (2008) *A Solution to the Problem of Low-Income Housing in Developing Countries by Use of Pre-fabricated System.* In Fahd D.D. (ed) Op Cit.

[24] Tipple, A. (2005) Self- help Housing Policy in a Zambian Mining Town. *Journal of Urban Studies*. 13(2) 38-42.

[25] Tugyan, D. (2007) *Low-Income Housing Systems*. In Fahd D.D. (ed), Op Cit. NISER, Ibadan

Instructional Explanation vs Self-Explanation: Which One Works Better?

Lai Chee Sern[1,2]
[1]Faculty of Technical Education, Universiti Tun Hussein Onn Malaysia
[2] Institute of Technology and Education, University of Bremen, Germany
*lcsern@uthm.edu.my

Abstract
In the present research, two different explanatory approaches – namely, instructional explanation and self-explanation prompts – were applied in example-based learning (learning from worked examples) in the domain of manufacturing technology. The main purpose of this investigation was to compare the effects of both explanatory approaches on topic knowledge acquisition, near transfer performance, and far transfer performance. Additionally, this research also attempted to examine the impact of cognitive mental effort investment on the aforementioned variables. To achieve the abovementioned objectives, a two-treatment-group and a control group with a pre- and post-tests measurement design was used. A total of 76 students was assigned to three groups (self-explanation group = 25, instructional explanation = 25, control group = 26). The results from the experiments suggest that the stimulation of cognitive processes by self-explanation prompts might result in a better topic knowledge acquisition and near transfer performance, but not in far transfer performance, for novice learners. In terms of far transfer performance, the provision of instructional explanations works as good as self-explanation prompts, despite having a tendency to outstrip self-explanation prompts. The results also reveal that a high mental effort investment does not guarantee a fruitful learning performance.

Keywords
Self-explanation; instructional explanation; worked example; cognitive load; transfer performance

INTRODUCTION

Basically, a worked example consists of a problem, the solution steps and the final solution itself. Learning with worked examples means that learners are presented with several examples of solved problem before they try to solve problems on their own. Learning with worked-out problems does not require learners to look for solutions by themselves; conversely, they are fully provided with solution procedures. By doing so, more working memory space is freed up, which may permit the learners to interact with more pieces of information without causing working memory overload.

The positive effects of learning with examples can be explained by cognitive load theory (Sweller, van Merriënboer, & Paas, 1998). The cognitive load theory describes three different cognitive loads during the learning process, namely, intrinsic, extraneous, and germane cognitive loads. Intrinsic cognitive load refers to the demands on working memory capacity caused by the complexity of a learning material or an instructional task. Extraneous cognitive load is induced by the format of the instruction, rather than by the intrinsic characteristics of a material or learning task. Extraneous cognitive load is commonly conceived of as ineffective load because it is not directly related to learning and interferes with schema acquisition. Similar to extraneous cognitive load, germane cognitive load is also influenced by the format of instruction or the external learning activities. The crucial distinction between these two types of cognitive loads is that germane cognitive load is attributed to the instructional activities that facilitate the acquisition of schema and new knowledge. This is to say that germane cognitive load is an effective type of cognitive load (Paas, Renkl, & Sweller, 2003). It is important to note that cognitive load theory assumes that the intrinsic, extraneous, and germane cognitive loads are additive, which means the total load from these three different cognitive loads should not surpass the working memory capacity in order to facilitate learning.

It is widely conjectured that learning from examples can supports the development of problem schema by modeling the structure of the problem. When learners learn from an example (a worked problem), they construct and subsequently store a problem schema according to the type of problem, structural elements information, problem situation, and processing operation in long-term memory (Chi & Glaser, 1985). Whenever they encounter a problem of similar type, the problem-solving schema (as one chunk information) is retrieved automatically from long-term memory. Eventually it turns out that the working memory load can be considerably reduced due to fewer active elements interacting in the working memory. In turn, more working memory space is available. In order to make the most of this free working memory, additional supportive instructional activities, which may bring on germane cognitive load (directly benefit learning), can be employed during the process of example-based learning. For instance, providing explanations or prompting learners to generate explanations to the solution steps is a learning activity that might produce germane cognitive load

because either providing or generating explanations may directly contribute to learning (Chi, 2000).

Basically, instructional explanation is designed to communicate a particular aspect of subject matter knowledge. This type of explanation is contributed by teachers or teaching materials (e.g., courseware, text books) during the process of learning and it is regarded as a powerful instrument to help learners understand the concepts, ideas, events, and procedures of a specific topic (Leinhardt, 1993). Self-explanation, on the other hand, is generally understood as a learning activity in which the learner generates explanations or rationales for the solution procedures of a worked-out problem for her/himself (Chi, 2000). These explanatory activities play an important role in worked-out problem learning because most, if not all, of the worked example typically contain unexplained solution procedures. This is problematic because knowing a problem's solution does not mean understand it, and understanding plays a major role in attaining transfer of learning (Ohlsson & Rees, 1991). This, in turn, might not bring positive contribution to learning in general and transfer performance in particular. In order to enhance transfer performance, some authors (e.g., Chi, 2000; Renkl, 1997) suggest that learners should overcome the incompleteness of worked-out solutions by engaging in explanatory activities, such as receiving instructional explanations or generating explanations.

BACKGROUND OF RESEARCH

The present research was conducted for several reasons. Firstly, the existing literature did not provide sufficient evidence to draw a solid conclusion regarding the effectiveness of self-explanation prompts and instructional explanation on learning outcomes. Secondly, most of the prior research focused on well-structured domains, and it is not certain if those research outcomes could be replicated in an ill-structured domain, like manufacturing technology. Thirdly, the research concerning learning from worked example in a computer-assisted instructional environment is relatively scarce in comparison to other learning environments (e.g., lecture-based environment).

In addition, mental effort was included in this investigation. Prior research (e.g., Wirth, Künsting, & Leutner, 2009; Große & Renkl, 2007) has shown the relationship between mental effort and learning outcomes. However, those research findings are not generalisable to other learning contexts. Therefore, the present research attempted to examine the influence of mental effort investment on learning outcomes in the context of example-based learning.

OBJECTIVES

In general, the present research aimed at comparing two explanatory procedures – namely, providing instructional explanations and self-explanation prompts – within the context of computer-based example-based learning for the ill-structured domain of manufacturing technology. The worked-out problems were constructed and presented in an order of increasing complexity (Collins, Brown, & Newman, 1989). Specifically, the present research attempted to investigate (i) the difference between instructional explanation and self-explanation prompts on topic knowledge acquisition, and on near and far transfer performance; and (ii) the relationship between mental effort and learning performance.

RESEARCH METHOD

To achieve the abovementioned objectives, a two-treatment-group and a control group with a pre- and post-tests measurement design was used. Specifically, topic knowledge acquisition, near and far transfer performance were assessed before and after the treatments, whereas the mental effort was measured after the pre- and post-tests.

Instruments

The self-developed pre-test (λ_6=0.63) and post-test (λ_6=0.65) were used to collect the data concerning topic knowledge acquisition, near and far transfer performance. The NASA Task Load Index (NASA-TLX) (developed by Hart and Staveland (1988) was used to measure mental effort invested by the experiment subjects. Several researchers (e.g., Gerjets, Scheiter, & Catrambone, 2006) have used this instrument for the same purpose in their studies. With regard to the reliability of NASA-TLX, the present study had obtained a reliability coefficient (alpha) of 0.80.

Sample

A total of 76 second-year bachelor students from the Faculty of Technical Education, Universiti Tun Hussein Onn Malaysia, were randomly assigned to three different groups: self-explanation prompts group (N=25), instructional explanation group (N=25), and control group (N=26).

RESULTS AND DISCUSSION

The research outcomes revealed that the learners who were prompted to self-explain may acquire more topic knowledge and tended to achieve higher gain scores in near transfer tasks (See Table 1). The ANOVA demonstrates that there was a significant difference between the experimental groups in which the F was significant beyond the 0.05 level in both topic knowledge ($F(2,69) = 8.04$, $p=0.001$, $\eta^2 = 0.17$, strong effect) and near transfer performance ($F(2,69)=5.32$; $p=0.007$; $\eta^2 = 0.11$, medium effect). In contrast, the learners who were provided with instructional explanations did not achieve the same performance level as the prompted learners did. In other words, self-explanation prompts demonstrated a superior effect on knowledge acquisition and near transfer

performance in comparison with instructional explanation.

Table 1: Means (standard deviations) of topic knowledge acquisition, near and far transfer performance of the pre- and post-tests scores.

		G1	G 2	G 3
Topic Knowledge Acquisition	Pre-test	6.25 (1.11)	6.26 (1.01)	5.32 (1.60)
	Post-test	6.29 (1.33)	6.83 (1.03)	6.92 (1.29)
	Gain score	+ 0.04	+ 0.58	+ 1.60
Near Transfer	Pre-test	9.69 (2.58)	11.96 (3.71)	10.88 (4.10)
	Post-test	9.73 (2.02)	12.22 (3.22)	13.96 (3.27)
	Gain score	+ 0.04	+0.26	+3.08
Fat Transfer	Pre-test	8.19 (3.00)	8.54 (2.34)	7.98 (3.41)
	Post-test	9.50 (2.87)	11.20 (3.39)	10.24 (3.01)
	Gain score	+ 1.31	+2.66	+2.26

G1=control group; G2=instructional explanation; G3=self-explanation

In terms of far transfer performance, there were no significant differences found between the instructional explanation, self-explanation prompts, and control groups. The possible explanations for this could be that:

- The existence of a conceptual or knowledge gap between the low and high complexity worked-out problems. With such a knowledge gap, the students are not capable of generating accurate explanations, which in turn might negatively influence learning.
- Complex worked-out problems might induce a high intrinsic cognitive load, which may reduce the working memory capacity. Consequently, there would not be sufficient working memory space left for beneficial cognitive activities, such as organising, interrelating, and constructing new information.
- Demanding students to write down their thoughts might impose an additional demand on their cognitive resources, which may not necessarily translate into beneficial cognitive processes. Therefore, it is conjectured that generating self-explanations in a written format might have introduced extraneous cognitive load, thereby leaving insufficient working memory capacity for the germane cognitive load. This might disturb learning.
- Instructional explanations are not necessarily compatible with a student's existing knowledge. As a consequence, the learners might not be able to follow instructor's explanations, or they might be confused with the given explanations.
- The redundancy effect might have occurred due to repeated information from the instructor and the learning materials. Spending the limited working memory capacity on the futile cognitive events, such as processing redundant information, is not likely to promote the transfer of learning, especially far transfer, which requires a higher level of cognitive processes.
- The floor effect might have taken place. The far transfer items could have been too difficult for all participating learners to solve correctly. Consequently, regardless of the instructional strategy used to assist the learners, they would not be capable of gaining high performance.

Although the current study failed to provide support for the superiority of either explanatory strategy, the data distribution seems to suggest that there is a tendency for instructional explanation to be more favourable than self-explanation prompts because the learners in the instructional explanation group yielded higher far transfer gain scores than those in the self-explanation prompts group and control group. It is suspected that the small number of experimental subjects (less than 30) was one of the reasons for the non-significant result.

With regard to the second research objective (the relationship between mental effort and test performance), the results (see Table 2) reveal that the relationship between mental effort and test performance was positive, but it was too weak and not statistically significant.

Table 2: Correlations between mental effort and performance gain score.

			Mental effort
Control Group	Pearson Correlation	Gain score	.22
	Sig. (2-tailed)		.31
Instructional explanation	Pearson Correlation	Gain score	.15
	Sig. (2-tailed)		.50
Self-explanation	Pearson Correlation	Gain score	.01
	Sig. (2-tailed)		.98

That is to say, a high mental effort investment does not guarantee a fruitful learning performance. Nevertheless, the data distribution seems to move towards the direction of a significant positive relation between mental effort investment and learning performance. The non-significant correlation might be

due to the small number of research subjects. In addition, it is discovered that the pattern of mental effort investment fits nicely into cognitive load theory. This finding supports the assumption that self-explanation prompts induce higher cognitive load during learning process, but the self-explainers may experience lower mental effort investment on a test.

CONCLUSION

In conclusion, both the provision of instructional explanations and self-explanation prompts produce similar results as far as far transfer performance is concerned. Nevertheless, the instructional explanation strategy seems having a tendency to be more effective. More research has to be done to draw a conclusive finding on this issue. On the other hand, the current results suggest that the stimulation of cognitive processes by self-explanation prompts might result in a better topic knowledge acquisition and near-transfer performance for novice learners. Meanwhile, it has also been found that the learning performance is not dependent upon the quantity of mental effort invested to a learning task. That is to say, a high mental effort investment does not guarantee a fruitful learning performance

REFERENCES

[1] Chi, M.T.H. (2000). Self-Explanation expository texts: The dual processes of generating inferences and repairing mental models. In R. Glaser (Ed), *Advances in instructional psychology*. (pp. 161-238). Mahwah, NJ: Erlbaum

[2] Chi, M.T.H. , & Glaser, R. (1985). Problem Solving Ability. In R. Sternberg (Ed). *Human Ability: an information-processing approach* (pp. 227-257). San Francisco: W.H. Freeman & Co.

[3] Collins, A., Brown, J.S., & Newman, S.E. (1989). Cognitive Apprenticeship: Teaching the Crafts of Reading, Writing, and Mathematics. In L.B. Resnick (Eds), *Knowing, Learning, and Instruction*. (p: 453-494). Hillsdale, NJ: Lawrence Erlbaum Assc.

[4] Gerjets, P., Scheiter, K., & Catrambone, R. (2006). Can learning from molar and modular worked examples be enhanced by providing instructional explanations and prompting self-explanation? *Learning and Instruction*. Vol:16 (2), pp.104-121

[5] Große, C.S., & Renkl, A. (2007). Finding and Fixing Errors in Worked Examples: Can this foster learning outcomes?. *Learning and Instruction*. Vol: 17, pp.612-634.

[6] Hart, S.G., & Staveland, L.E. (1988).Development of NASA-TLX (Task Load Index): Results of experimental and theoretical research. In P.A. Hancock, & N. Meshkati (Eds), *Human Mental Workload*. (pp.139-183). Amsterdam: North Holland

[7] Leinhardt, G. (1993). Instructional explanations in history and mathematics. In W. Kintsch (Ed.), *Proceedings of the Fifteenth Annual Conference of the Cognitive Science Society* (pp. 5-16). Hillsdale, NJ: Lawrence Erlbaum Associates

[8] Ohlsson, S., & Rees, E. (1991). The function of conceptual understanding in the learning of arithmetic procedures. *Cognition and Instruction*. Vol: 8(2), pp.103-179

[9] Paas, F., Renkl, A., & Sweller, J. (2003). Cognitive Load Theory and Instructional Design: Recent developments. *Educational Psychologist*. Vol: 38(1), pp.1-4

[10] Renkl, A. (1997). Learning from worked-out examples: A study on individual differences. *Cognitive Science*. Vol: 21, pp.1-29

[11] Sweller, J., van Merriënboer, J.J.G., & Paas, F. (1998). Cognitive Architecture And Instruction Design. *Educational Psychology Review*. Vol: 10, pp.251-296

[12] Wirth, J., Künsting, J., & Leutner, D. (2009). The impact of goal specificity and goal type on learning outcome and cogntive load. *Computer in Human Behavior*. Vol: 25, pp.299-305

Integrated Framework for Joint Sustainability and Quality Attainment of Construction Projects in Developing Countries

Ngu Hung Lung[1,*] and C.P. Gomez[2]
[1,2]Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja, Batu Pahat, Johor.
*nhunglung@hotmail.com

Abstract
This research takes into account the concept of quality and sustainability as concepts that need to be coupled in order to have an integrated focus that does not generate problems related to a limited focus on both issues when tackled as a non-integrated practice. The proposed research methodology is using a mixed method approach: both quantitative and qualitative, using interview method and questionnaire data collection method. Research will involve the personnel from management level such as Managing Director and Quality Manager from ISO 9001 certified companies. Data will be analyzed through statistical method of analysis using SPSS and description method for analysing interview data. Literature Review and followed by Delphi Surveys used to identify the micro-level performance measures for Sustainability and Quality achievement in construction projects. The initial criteria of Sustainability-Quality Performance (SQP) Criteria for construction projects have been identified. These criteria will be clarified through Delphi Study in order to get the high validity of performance criteria for framework development.

Keywords
Sustainability, Quality, Micro-level Performance Measure, Integrated Sustainability and Quality Framework.

INTRODUCTION

The needs and demands of the present market which is becoming more and more global and competitive have favoured the development of quality management in large and small companies [1]. Whilst, it is only of recent that the principles of sustainable development is being focused by more and more businesses and aligning this concept in their business activities [2].

Built environment has a huge impact in the whole organisation, not only on the finished product's client and also the organisation which implement the construction works but also the community surrounding the site, as well as the global community in a wider sense of green house gas emissions (CGH). Apart from that, as noted by [3], one of the sustainable construction key challenges is to produce buildable and good quality products. [4] also acknowledged that the sustainable design, construction and operation of projects are becoming a new frontier for quality management. For instance, [5] also proposed 4 "pillars" of the principles of sustainable construction, which are 'social', 'economic', 'biophysical', and 'technical'. Hence, it is evidence that sustainability aspect have to integrate with quality management in order to be more effectively used in construction industry.

SUSTAINABLE DEVELOPMENT AND SUSTAINABILE CONSTRUCTION

Sustainable Development is defined as "development that meets the needs of present without compromising the ability of future generations to meet their own needs" (Brundtland Report, 1987). According to Department of the Environment, Transport and the Regions (DETR): London, sustainable development is the simple idea aimed at ensuring a better quality of life for everyone, now and for generations to come through achieve social, economic and environmental objectives at the same time. Figure 1 below shows the relationship among these three objectives, and this will provide for:

- A more inclusive society.
- Increased economic prosperity.
- Less pollution and more efficient use of natural resources.

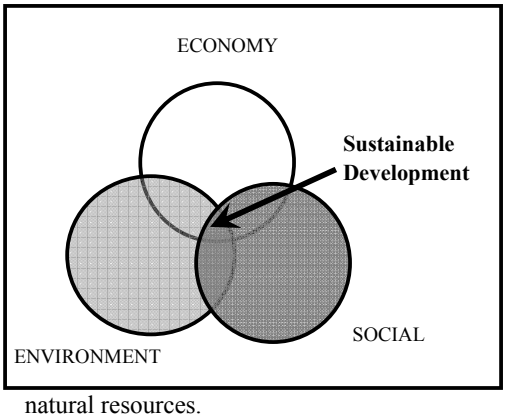


Figure 1: Three Components of Sustainable Development (from Anumba, 2006) [6]

[1] Masters student, Dept. of Construction and Property Mgmnt., Faculty of Tech.. Mgmnt., Business and Entrepreneuship.

[2] Senior Lecturer, Dept. of Construction and Property Mgmnt., Faculty of Tech. Mgmnt., Business and Entrepreneuship.

Sustainable Construction is defined by the *Conseil International du Batiment* (CIB, 1994), as "… creating and operating a healthy built environment based on resource efficiency and ecological design" [6]. Sustainable Construction is generally regarded as a subset of sustainable development, with the three key components- social, economic and environmental also applicable [7].
There are seven principles articulated by CIB as follow:

1. Reduction of resource consumption
2. Reuse resources
3. Use of recyclable resources
4. Natural protection
5. Toxic elimination
6. Life-cycle costing application
7. Focus on quality.

It is noted here that quality is only assumed to be one of the seven principles of sustainable construction. This research emphasizes on sustainable quality of construction product of construction process taking into consideration the 3 components of sustainable development.

CONSTRUCTION QUALITY

The definition of quality can be a complex matter [8]. Quality cannot be defined easily and an understanding of what quality is can only, at best, be described and explained, albeit within its own frame of reference for a specific construction [9]. This is due to the unique characteristics of the construction project where for every project there is different of working environment and the peoples working for it.
In the construction industry, quality is defined mainly in terms of product quality. That is:

1. Totality of features required by a product or services to satisfy a given need [10]
2. Fitness for purpose [10]
3. Meeting specification [11] & [12]
4. Function ability [13]
5. User expectation and satisfaction [13]
6. Participants' satisfaction, these participants include client, design team leader and construction team leader [13]

However, there is an increasing number of perceptions on quality that take into account the delivering of quality in terms of total process which however still lacks the inclusion of the concept of sustainable quality. In order to quantify construction quality, [14] divide quality in construction into 3 main groups, they are:

1. Corporate quality which refer to image that customers have of an organisation.
2. Product quality is referring to the quality that associated with the users and occupants of the finished facility.
3. Service quality refers to the service while the contractors implement the main responsible for building a quality product.

On the other hand, [15] divides quality into 2 main categories, which are product quality and process quality. There is great potential for quality improvement in the construction process within the three main phases in the life cycle of construction project. They are design, construction and operation phase. Product quality refers to the quality of elements directly related to the physical product itself while process quality is referring to quality of the process that causes the product to be either acceptable or not [16]. Process quality refers to achieving quality in the way the project is organized and managed in three phases of design, construction and operation and more emphasis is given to process quality to increase product quality and to satisfy all stakeholders in the industry [15].

CONTRACTORS' SUSTAINABILITY AND QUALITY PERFORMANCE

In construction industry, contractors or sub-contractors are the one who undertake almost all of the works during construction phase. As argued by [17], in most projects, the contractor is responsible for the working environment during construction in terms of health and safety and the choice of construction methods. For instance, [18] purpose the contractor quality performance evaluation model. This evaluation model is based on the fact that the quality of the work performed (i.e. the product) by the contractor, the quality with which it is performed by the contractor (i.e. the service), together with the contractor's corporate culture of quality-related matters are very important parameters in the customer satisfaction equation [18].

[19] noted that construction activities are major contributor to environmental pollution, but it appears that little study has been conducted to investigate measuring the environmental performance by contractors during the construction process. Further more, [19] argued that a contractor plays an important role in protecting the environment, and contractor's environmental performance has a strong link with the overall environment performance across project lifecycle.

In terms of construction quality also, [18] acknowledged that the areas of material and component selection, on site project quality, project management activities, and project quality management systems are the responsibility of the contractor which contribute to project-level quality.

PROBLEM STATEMENT

"One-off" nature of projects in the construction industry is the challenge to the provision of a quality

outcome. It is argued that only for each phase of construction project is properly integrated will only yield to excellence. In order to use integrated approach to quality requires the adoption of a system approach, in which among other things, careful consideration is given to interactions between the phases [4]. This is also noted by Deming (1982) that 85% of the problems in the delivery of goods and service are caused by the system. For instance, [20] argued that construction professions are now faced with the task of understanding and translating strategic sustainability objectives into concrete action at project-specific level and requires using a holistic approach to facilitate decision making in order to translate the national strategic objectives at the micro-levels into concrete practical actions.

The current scenario of construction industry is still lagging performance in the aspect of quality and sustainability as the unique characteristics of construction industry which are consists of different parties and process involve, it is important for us to tackle the key stakeholders which are contractors who undertaken the production work to produce the product. It is noted by [4], the sustainable design, construction and operation of projects is becoming a new frontier for quality management. In which, 'process' has been identified by the construction industry as an important issue to address. It is recognized that in order to deliver a 'construction product' on time, on cost and of the highest quality, it is critical to manage the process (and the problems) effectively [21]. Whilst, the aspect of sustainability also argued by [22] that there are some principles of sustainable development are best implemented within the process rather than by being embedded in the product.
[23] stated that if the management of the process is good, the products or the services that are provided will be good too. For instance, Egan (1998) and Latham (1994) also noted that the construction industry has set itself the target of moving away from functional thinking and towards the process based philosophy, in order to achieve significant productivity improvements.

However, the use of quality assurance in construction concentrate on prevention, focus on how procedures can be adjusted a achieve products which satisfy a specific quality standard. But, there is a weakness that QA does not link the quality of the management process with the quality of the products being made (Toakley and Marosszeky, 2003).

In the reference [24], noted that implementation of QMS will improve the overall construction process, which it is not true for construction industry. It is because as argued by [25], for construction industry, contractors or sub-contractors are not involved during early stage of project life cycle which is during the design phase, this have affect the problem to implement quality in order successfully transfer to field operation [26].

There is a move towards the use of an explicit project quality plan (PQP) [8]. But, the use of PQP only is not sufficient enough to achieve quality of end product; it is just a documented guideline. As stated by [27], PQP being a project-based QMS document and it is part of project-based QMS. Hence it can be concluded that PQP is not a QMS for the use in project level. As pointed out by [8] also, managing relationship is a crucial skill in a project-based industry and should radically address quality by work with its supply network partners.

Even there is important for construction to create wealth for human, it create "problems" to human also in terms of environmental and social degeneration. As stated by [28], "The construction industry as a whole has to rapidly come to terms with the broader environmental and social agenda that is presented by the concept of sustainable development" whilst as stated by [29], construction is not an environmental friendly process as it is being practised. [30] also acknowledged that the built environment affects all human activity. [29] grouped the impact of construction process into two main categories, which are ecosystem damage and resource depletion.

For instance, [3] has proposed Integrated Management Systems implying towards sustainable QMS, however, it only addresses safety, quality, and environmental.
SQP as proposed in this research is to be validated as a framework to provide the necessary statement and practice for achieving sustainable quality management.

OBJECTIVE OF THE RESEARCH

The objectives of this study are as follows:

1. Identify micro-level performance measures for Sustainability and Quality achievement in construction projects.
2. Develop an Analytical/Assessment Framework for Sustainability-Quality Performance (SQP) of construction contractors.
3. Investigate the level of Sustainability and Quality practice of selected G7 construction contractors by using the developed framework.

SCOPE OF THE RESEARCH

This research will focus on construction contracting companies which have the ISO 9001 certification. The companies in this study are Malaysian construction companies with grade G7 (CIDB categorization which is based on 3 main criteria: tendering capacity, financial capacity, and availability of human resources). Research will involve the personnel from (i) Senior Management level such as Managing Director and (ii) Middle Management, such as Quality Manager.

RESEARCH METHODOLOGY

The research methodology is mixed method, both qualitative and quantitative, using interview methods and questionnaire data collection methods.

Data Collection Method

This research will use a mixed method approach consisting of qualitative and quantitative methods. Mixed methods studies will be undertaken in order to minimize discrepancies between the data collected during the study and the phenomenon of the real world [31]; hence this research will be undertaken by using both qualitative and quantitative approaches. In fact, as argued by [32], through this kind of research approach, it can be look to the 'what" and 'how" to research which is to better understand the complexity of the social phenomena being studied [33]. For quantitative method, several questionnaires will be sent out via e-mail or post. For the qualitative method, interview will be carried out amongst personnel from management level. The purpose of organizing an interview session is to acquire in-depth data on the practice of sustainability and quality in the construction industry. The two methods, i.e. qualitative and quantitative are integrated during the interpretation phase of the study [32]. In this study, the qualitative data function is to help explain and interpret the findings of the primarily quantitative study [33].

The first step of this research is to identify the criteria for sustainability and quality performance (Objective 1). This will achieve through literature review. The identified criteria of measurement from literature review to be clarified and evaluated by internal and external experts in the field of sustainable development and quality management by using Delphi Surveys.

Objective 2 achieved by developing an assessment/analytical framework for assessment by using the criteria after clarify and evaluate by experts.
The objective 3 will investigate the level of sustainability and quality practice of selected G7 construction contractors by using the developed framework. In order to do in-depth study regarding present condition of sustainability and quality practice, interviews will be carried out. The data that is gathered from interviews will transform from tape recorded into narrative form. There wouldn't use any computer packages such as NVIVO or SPSS Text Analyser since only few of interview data collected and the use of traditional means will be sufficient enough (Adams, et al., 2007).

Data Analysis

Data will be analyzed through statistical method of analysis using SPSS and description method for analyzing interview data. This study will adopt a simple random sampling procedure and it will result high generalisability of findings [34]. Therefore, following Krejicie and Morgan (1970) and Cohen (1969) in [34], the recommend sample size to represent is 297, as the population number of ISO certified G7 contractors are 1242 [35].

FINDINGS

Figure 2 in Appendix A shows the initial Integrated Operational Framework based on earlier work of Gomez and Ngu (2010) and Hill et al. (1994). The identified criteria will validated through Delphi Survey.

SIGNIFICANCE OF STUDY

Through this research, the developed analytical framework can be used to measure the current level of sustainable quality management practice in Malaysian construction industry will be identified; it can help the construction industry in assessing the level of sustainable quality management practice.
As pointed out by [36], limited research has been conducted on quality management (QM) practices. Research on QM practices used to establish which practices are actually applied, to what extent and how QM can be best advanced in the industry. On the other hand, there is lack of consensus on what constitutes excellence in building assessment performance, covering the overlapping dimensions of social, economic, and environmental [7]. Hence the purpose of indicators is to provide a tool for guidance in sustainable quality management, including measures of its implementation and to provide the better understanding of the real phenomena.

CONCLUSION

This research aims to develop an assessment/analytical framework in order to measure the current practice of Sustainable and Quality Performance (SQP) in the Malaysian construction industry. Through this research the level of sustainability and quality management practice in the Malaysian Construction Industry will be identified. The focus will be on investigation the effectiveness of sustainability and quality currently implemented.

ACKNOWLEDGMENTS

The authors would like to thank **Universiti Tun Hussein Onn Malaysia** for supporting this research under the Postgraduate Incentive Research Grant.

REFERENCES

[1] Pina,J.A.T. & Sellés,M.E.S., "Management and measurement of quality in ISO 9000 organisation: an empirical study in Spain." *Total Quality Management*, 2008, Vol. 19, Nos. 5-6, pp.481-492.

[2] Keeble,J.J., Topiol,S. & Simon, B., "Using indicators to measure sustainability performance at a corporate and project level." *Journal of Business Ethics*, 2003, 44, pp. 149–158.

[3] Griffith, A. "Management systems for sustainable construction: integrating environmental, quality and safety management systems" *International Journal of Environmental Technology and Management*, 2002, Vol.2, No. 1/2/3, pp. 114-126.

[4] Toakley, A.R. & Marosszeky,M. "Towards Total Project Quality – A Review of Research Needs" *Engineering, Construction and Architectural Management,* 2003, Vol. 10, No. 3, pp. 219-228.

[5] Hill, R.C. & Bowen, P.A.Sustainable construction: principles and a framework for attainment. Construction Management and Economics. 1997,15(3), pp. 223-239.

[6] Anumba,C.J. "Innovative systems for sustainable construction," presented at the proc. of the 6th Asian-Pacific Structural Engineering and Construction Conference (ASPEC 2006), 5-6 September 2006, Kuala Lumpur, Malaysia.

[7] Kibert, C.J. "Sustainable construction: green building design and delivery". 2nd ed., United States: John Wiley & Sons, Inc., 2008, pp.6.

[8] Barrett, P. "Systems and relationships for construction quality." *International Journal of Quality and Reliability management.* 2000, Vol. 17, No. 4/5, pp. 377-392.

[9] Low, S.P. & Goh, K.H., "Construction quality assurance: Problems of implementation at infancy stage in Singapore" *International Journal of Quality and Reliability Management*.1992, Vol. 11, No. 1, pp.22-37.

[10] Prafitt, M.K. & Sanvido,V.E., "Checklist of critical success factors for building projects', *Journal of Management in Engineering*, 1993, Vol. 9. No.3.pp.243-249.

[11] Songer, A.D., Molenaar, K.R. and Robinson, G. D., "Selection factors and success criteria for design-build in the US and UK,"*Journal of Construction Procurement,* 1996, Vol. 2. No. 2. pp. 69-82.

[12] Wateridge, J., "IT projects: a basis for success," *International Journal of Project Management.*, 1995, Vol.13, No. 13, pp. 169-172.

[13] Chan, A.P.C. and Chan, A.P.L., "Key performance indicators for measuring construction success', Benchmarking: *An International Journal.* 2004, Vol. 11, No. 2, pp. 203-221.

[14] Delgado, D.J. & Aspinwall, E., "A framework for building quality into construction projects-Part I.," Total *Quality management*, 2008, Vol.19, Nos. 9-10, pp. 1013-1028.

[15] Arditi, D. & Gunaydin, H.M., "Perceptions of process quality in building projects." 1999, *Journal of Management in Engineering*. Vol. 15, No. 2, pp. 43-53.

[16] Nagasaku, C., and Oda, M., (1965) "Planning and execution of quality control," Tokyo: Juse Press.

[17] Cole, R.J. Building environmental assessment methods; assessing construction practices. *Construction Management and Economics*, 18(8), pp. 949-957.

[18] Yasmis, Firuzan, Arditi, David and Mohammadi, Jamshid(2002). Assessing contractor quality performance, *Construction Management and Economics*, 20 (3), pp. 211-223.

[19] Yao, H., Shen, Y.L., Hao, J.L. & Yam, M.C.H. (2007). A fuzzy-analysis-based method for measuring contractors' environmental performance. *Management of Environmental Quality: An International Journal.* Vol. 18. No. 2, pp.442-458.

[20] Ugwu, O.O. & Haupt, T.C. "Key Performance Indicators and assessment methods for infrastructure sustainability-a South African construction industry perspective. *Building and Environment* 42, 2005, pp. 665-680

[21] Cooper, R., Aouad, G., Lee, A., Song, Wu, Fleming, A., & Kagioglou, M. "Process Management in Design and Construction." Great Britain: Blackwell Publishing Ltd., 2005.

[22] Kaatz, E., Root, D. and Bowen, P. (2005). "Broadening project participation through a modified building sustainability assessment". *Building Research and Information*, 33:5, pp. 441-454.

[23] Turk, A.M. "ISO 9000 in Construction: An Examination of Its Application in Turkey." *Building and Environment*, 2006, 41, pp. 501-511.

[24] Ilias Said, Adul Rahman Ayub, Arman Abd Razaki, Tee, Kuan Kooi, (n.a.). "Factors affecting construction organisation quality management system in the Malaysian construction industry". Retrieved May, 5, 2010, from page 1 at eprints.usm.my/16080/1/Ilias_said_2.pdf

[25] Abdul-Aziz, A.R. "The Realities of applying Total Quality Management in the Construction Industry." *Structural Survey*, 2002, Vol, 20, No. 2, pp.86-96.

[26] Haupt, T.C. & Whiteman, D.E. "Inhibiting factors of implementing Total Quality Management on construction sites." *The TQM Magazine*, 2004, Vol. 16, No. 3, pp. 166-173.

[27] Abdul Hakim bin Mohammed & Mat Naim bin Abdullah @ Asmoni. (2006). Quality Management System In Construction. In: International Conference on Construction Industry 2006, 21st June – 25th June 2006, Padang, Indonesia.

[28] Curwell,S. & Cooper, I. "The implications of urban sustainability." *Building Research and Information*. 1998,Vol. 26. pp.17-28.

[29] Li, X.D. et al. "An LCA-based environmental impact assessment model for construction processes" *Building and Environment*. 2010, Vol. 45. No. 3. pp. 766-775.

[30] Pitt, M., Tucker, M., Riley, M. & Longden, J., "Towards sustainable construction: promotion and best practices," *Construction Innovation*, 2009,Vol.9.No.2, pp.201-224.

[31] Richard Li-Hua "Technology & Knowledge Transfer in China". Great Britain: Ashgate Publishing Limited, 2004, pp. 12.

[32] Creswell, J.W. "Research Design: Qualitative, Quantitative, and Mixed Methods Approaches". 3rd Ed. United States: SAGE Publications, Inc., 2009, pp.14-15.

[33] Greene, J.C. "Mixed Methods in Social Inquiry." United States: John Willey & Sons, Inc., 2007.

[34] Cavana, R.Y. Delahaye,B.L., & Sekaran, Uma. "Applied business research: qualitative and quantitative methods., 2001, Singapore: John Wiley & Sons, pp. 268 & 278.

[35] CIDB (2008). Training Module on Waste Management at Construction Sites. Construction Industry Development Board, Kuala Lumpur.

[36] Leonard,D., "Quality Management Practices in the US Homebuilding industry", 2010, *The TQM Journal*. Vol. 22, No. 1, pp. 101-110.

[37] ALwaer, H. & Clements-Croome, D.J. "Key performance indicators (KPIs) and priority setting in using the multi-attribute approach for assessing sustainable intelligent buildings" *Building and Environment*. Vol. 45, No.46. , 2010, pp.799-807.

[38] C.P.Gomez & H.L. Ngu. Client-led integrated sustainability-quality management attainment assessment framework. *Proceedings of 4th International Conference on Built Environment in Developing Countries, Penang, Malaysia,1-2 December 2010*. (To be published)

[39] Hill, R,C., Bergman, J.G. & Bowen, P.A. A framework for the attainment of sustainable construction. *Proceedings of the First International Conference of CIB TG 16, November 6-9, 1994, Tampa, Florida, U.S.A.* pp. 13-25.

Determines of Teacher's Practice of infusing Islamic Manners (ADAB) in the Secular Classroom in Southern Thailand

Samsoo Sa-/
International Islamic University, Malaysia
iium@yahoo.com

Characteristics of Academic Procrastination among the Postgraduate Students of IIUM

Abdul Rahman Muhammed Shittu Balogun
International Islamic University, Malaysia
Abdrahman082000@gmail.com

School Supervision: Problems And Prospects

Lasisi, Abass Ayodele
International Islamic University, Malaysia
abasstps97@yahoo.com

Abstract
Over the past decades there has been problem in monitoring institutions towards the achievement of excellent. Supervision as a major task in education can be traced back to Islamic era; this is to emphasis the contributions/impacts of the Islamic scholars in citadel of learning. Supervision has been a service provided by government through the efforts of her agencies and /or other corporate private bodies for school excellence. This article is focused at addressing the major flaws that cause hindrance to most efficient and effective supervision activities in schools such as non-define supervisor, poor curriculum supervision and poor professional development programme supervisions. Effective supervision has a definite role to play in the over-all interest of an institution which is attached to an excellent and competent supervisors, well equipped institutions and good instructors. Besides, supervision is an important tool towards the achievement of excellence through efficient school leaders that can maintain excellent in students and staff performance to meet the society needs. Views and perceptions expressed by other authors are considered in order to provide major framework for supervision of institutions of learning. As lack of through supervision manifests in our institutions today, this article strives to give prospect to institutional stakeholders and administrators to tackle the challenges in school supervision.

Keywords
Supervision, flaws in supervision, Strategy, excellent institution

INTRODUCTION

There has been continues problem facing administrative units of the educational institutions towards strategic monitoring and effective supervision of educational activities for excellent achievement. Many countries of the world have focused significant attention to improve the institutions; primary, secondary and tertiary institutions for betterment and to turn out good citizen for the benefit of society. However, some schools are eager to become and remain competitive in the educational marketing sectors. Main while, federal ministry of education approves some private institutions in order to achieve quality education through efficient supervision by her agencies and substantial administrators. Under the relentless pressure of educational providers, there are some institutions and administration units which undermine the essence of supervision. To the effort of reducing the problem facing supervision of school for excellence, government establishes an Institute that concentrates mostly on educational management and leadership such as colleges of education, institute of education and many others throughout the world. In an excellent educational institution, the task of an effective supervisor is to consider the activity of staffs as well as rebuilt the processing methods of supervision for school excellence. Supervisors are expected of possessing strategy of supervision, this will improves the activity of academic environment. In abroad way, school is an organized community of academia where learning and teaching occurs in continuous manner. There should be a thorough supervision by the school administrators for proper accountability. Teachers are to ensure that all students in school reach acceptable levels of achievement. In addition, students are expected to reflect on how they are learning and to be more aware of learning strategy from their teachers in order to achieve the essence of supervision. Consequently, many stakeholders often blame the tutors due to poor performance of the students. Similarly, administrative units do receive set of blame due to poor performance of human resources management. It is quiet unfortunate that, this poor output from both human resources management and students performance has to be criticized and evaluated through the inconsistence act of supervision. This is because supervisors are designated personnel who are in charge of administrative units and learning developments. If there is poor performance and ineffective supervision, the critics should be directed to the school supervisor. Indeed, supervisors have to look for observable evidence of teaching achievement from students and external feedbacks from the research survey of an institution. This survey may be from government evaluation, shareholder's observation or customer's perceptions towards school improvement. Islamically, Prophet Mohammad and his Khalif did not leave any stone unturned in terms of proper administration and supervision in any forms of live. Thus, supervisors are to aware the outcomes or the feedback from external factors, and students' achievements with relation to standard curriculum, rather than outdated strategy of supervision. What out dated strategy implies of; this is an act of sitting in the office without moving round each sections of the institution for proper assessment and evaluations both from the student to teacher, teacher to administrative department. By going through Khalif Umar bin khattab, he enjoys moving round each province to ensure good result/outcome from his leadership and his delegate to each district. This is because he

believes in applying Islamic principles in administration for the benefits of the society. We are in new age that different challenges appear in teaching-learning environment, and this uniqueness requires momentous supervision strategies.

Supervision as a way for learning achievement

Supervision is synonymic as to "watch over," "direct," "over-see," "superintend". Supervision is a major function and explicit tool that draws together the discrete elements of instructional effectiveness provided through the exertion of specific manpower into whole-school action (Glickman, et al., 2007). It has been emphasised that supervision task is not for school administrator only; as this in mind, teachers are responsible for their students activities in order to achieve the goal and objectives of education.

According to Sergiovanni and Robert, (2002: 4) "the job of the supervisors is to help teachers pinpoint the source of the developing difficulty, bring in additional resource people when called for to work with the teachers, and to monitor the gradual improvement in the students' learning. In this sense, teachers, too, have supervisory responsibilities and to report constantly to the designated supervisor. Further that, no matter how capable and designated the supervisors used to be, as long as supervision is viewed as "doing something *to* teachers and *for* teachers but not *with* teachers." By reporting for significant leading supervisor, this may reduce problems that can be emphasised as threat to the institution. Without this, its potential to improve schools will not be fully realized.

Similarly, Good (1945:40) offer a comprehensive definition that supervision is efforts of designated school officials directed towards providing leadership to teachers and other educational workers in the improvement of instruction; it involves the stimulation of professional growth and development of teachers, the selection and revision of educational objectives, materials of instruction, and methods of teaching, and the evaluation of instruction.

In support of Good's definition, Ogunu (1998) stress that educational supervision is the art of overseeing the activities of the teachers and other educational workers in a school system to ensure that they conform with generally accepted principles and practice of education and the stipulated policies and guidelines of the education authority which controls the system of education, and providing professional guidance to them to improve the conditions which affect the learning and growth of students and teachers. Those that dedicated to this task must be professional in order to satisfy the needs of both internal and external environment.

Educational administrators mostly selected by government of a country under the Ministry to overseeing the activities in the school for effective teaching-learning process. To appreciate the selecting board, this selection task at times based on qualifications but neglect ion of specialization and years of experience in teaching-learning activities. Thus, technical knowhow in supervising the institutions is most important which needs more emphases. Basically, selection of supervisor has to do with specialization; this means that those who are specifically trained in the field of leadership and management are to serve as supervisor in schools. Besides, it is there passion and they are experts in this task. This will reduce the problems that facing the effective supervision of schools and it will develop the essence of good education. As emphasised by Khalifa Umar bin khattab that "put the right person in the right position". He understood the important of "Technical knowhow" and passion in designated personnel in a position. In this context, this is *Adab* (mannar) which has to be considered most especially the Muslim world in school supervision and other ways of live. In light to this, there are many scholars, Consultants, Professors, Doctors and others who have a sense of "placing the right in the right place".

In primitive society, only the privileged citizen or people were selected to receive instruction under the complex colonialism. People have freedom to become whatever they want in democratic situations without thorough supervision. The youths of today likewise the elders are to receive the best and quality of education as a right which is a provisional duties that made as compulsory task for the government which required quick response through sufficient supervision. Teachers and supervisors must keep pace fast with tremendous advances in supervision tasks in order to achieve the goal of education. Supervision as a major task in education which can be traced back to Islamic era; this is to emphasis the contributions/impacts of the Islamic scholars in citadel of learning.

To flash back, in classical Islamic education era where madrasa was an institution of learning par excellence, this citadel was devoted to teaching of Islamic tradition through the uses of Holy Qur'an. The instructors were really concentrated on teaching the pupils how to read and write without specific curriculum. In short, the supervision tasks were centered to the parent of the pupils whom were in position to define and determine what to teach and how to supervise the pupils. According to Shalaby (1954) it was emphasised that the parents direct the activities of teaching where the preceptor teaches the parent wises subjects to the students. Amr ibn Utbah says:

> *"first thing to teach my sons is to improve your own manners because my sons will be deeply*

> *influenced by you and will favour what you do and abhor what you avoid. Teach them Qur'an but without wearying them of it….teach them the virtues of wise men and keep them away from women's conversation"(Shalaby, 1954).*

Supervision has being observed since old ages. Here, it was observes that curriculum was indirectly designed verbally by the parents without breath space for teachers supervision. For the clear picture, Umar bin Al-Khattab the Holy Prophet Mohammed Caliph supervised his companion; governor of the provinces, tax collectors, the soldiers and so on. Khaliq, (2009) relates that the best examples of good leaders and supervisors in history of Islam can be found in the managerial characters of Sayyidina Umar Al-Khattab and Ali ibn Abi Talib. In addition, there are a lots of impact seen in the live of Muslims from the act of supervision in education most especially Ibn-khalidun, Al-farabi, Al-Attas many others. Supervision is monitoring tool which engaging the leaders to control, and it is specifically define what the subordinates have to do in order to achieve the objectives and main target of educational Institution.

However, there are still difficulties in understanding 'who is to be the supervisor', 'whom to supervise' and 'what to supervise'. Consequent to this, appropriate supervision needs to be emphasised and clearly understood by both ordinates and subordinates in our educational institutions.

Who Is A Supervisor?

It is perceive and clearly identifies by some people that who involves in supervision task is known as a supervisor. It is undoubted true that pervasiveness of people about supervision task needs to be changed or emphasised, due to the fact that "who to be a supervisor" have to be mounted or perceive through managerial functions and technical knowhow.

According to Peter and George, (2004) define supervisor as a trained auxiliary or staff personnel whose primary function is the provision of service cordial with supervision roles in an organisation. Indeed, the role of supervision today requires action and enrich in feedback from external factors which should be aimed at improving instruction and the instructional program but it is quiet unfortunate today, people in charge of supervision are not technical knowhow, while supervision task beyond these perceptions.

The roles of supervisors are ignored and undermine in our institutions and assumed to be known. This is because selected supervisor thought they need not to develop themselves regarding to modern approach of supervision. As a result, the subordinates; teachers, administrative assistance and others in human resource are struggling to find out what to do/or ways out of problems facing the institutions because the ordinate fail to understand the role requires in supervision. With high and poor clue of supervisors' responsibilities, they are less committed to making supervision task successfully. Thus, Ministers, local authorities of education, staff members, principal, consultants, department heads, directors, deans, Vice chancellor, Rectors, coordinators, chairmen, senates and teachers are all concerned with improving the educational system either at micro level or macro levels through effective supervision.

Having identifies the main supervisor; supervisor's job is to fulfill the objectives for the school's supervisory program. The ultimate responsibilities expect; coordinating, evaluating, assessing and be a group leader. The feature for supervision today includes the factors of objectivity, systematic planning and procedures, a democratic approach, a creativity atmosphere, pragmatic orientation, and a lot of experimentation and evaluation. Hence, supervisor expect of possessing personal traits that will allowed him or her to function and work harmoniously with subordinate in other to perform effectively. In this sense, Bernstein, (2004) stress that supervision is a process by which some person or group of people is responsible for providing a link between individual teacher needs and organizational goals so that individuals within the school can work in harmony toward their vision of what the school should be.

Nevertheless, effective supervision requires knowledge, interpersonal skills, and technical skills-all suppose to be the components as identities of committed supervisor. These can be inform of supervisory tasks as direct assistance to teachers, curriculum development, professional development, group development, and action research (Glickman, et. al., 2007). This adhesive pulls together organizational goals and teacher needs and provides for improved learning environment. Thus, supervisor has to be identified with the above characteristics and having knowledge of alternative as a solution to the hindrances that might be the obstacles to school supervision for excellent achievement.

The Major Flaws That Cause Hindrance to Most Efficient and Effective Supervision Activities in Schools

Many institutions have good vision and mission but purpose of vision and mission is not reflect in the act of supervision's activities of the school leaders as most top executive in supervision. The purpose of supervision is to increase the opportunity and the capacity of the institution in order to contribute more to the quality outcomes of the school. As mention earlier, that "who, whom, and what" to supervise needs constant consideration and inculcate in educational planning. The hindrances to most efficient and effective supervision activities in schools today

are brooding over non-define supervisor, poor curriculum supervision and poor professional development programme supervisions. With these in mind, the considerable frame work of this paper is to be understood and how efficient and effective supervision contribute to academic achievement through perfect supervision. Besides that, this will show case the problems in non-define supervisor, poor curriculum supervision, as well as poor professional development programme supervision in our institutions.

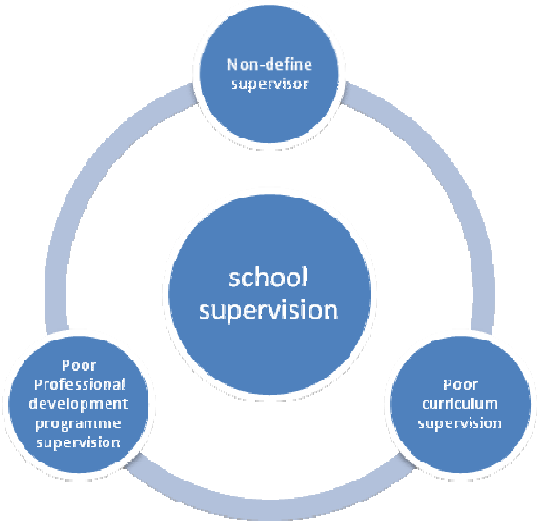
Flaws in school supervisions today

Certain supervision trends to have emerged and persisted, affecting the school systems. They can be classified as flaws that make supervision task failed in our institutions today. Supervision is one of management function, thus to regard a supervision task an excellent, supervisors need to revolve around the concepts of Islamic perspective such as *Ihsan, justice and benevolences*. Khaliq (2009) stresses that the concept of justice is implies the rendering of what is rightful to whom it is due. Benevolence is a concept which comes into existence when more than just the minimum standard is contributed in what one undertakes. Further that, organizational failure are inevitable when supervisor is unable to respond appropriately where required and lacking the desire to adopt to change.

The following flaws need changes;

- ***Non-define supervisor***: By rendering what is right to whom it is due. Everybody in the establishment would know "who is to supervise, who is to report to, what is the role of each in the establishment". As a result, define supervisor- will enable subordinate concentrate for positive output in the system. Similarly, the roles and experts in supervision task would be known. This would allow the problematic underlying in supervision accessible.
- ***Poor curriculum supervision***: those that engaged in supervision are lacking curriculum supervision strategy. Curriculum has to follow the strengths of the day not stand still. A quality curriculum and effective instruction are key elements to ensure successful teaching and learning in schools (Grigsby, al et., 2010). Omar, (2010) asserts that changing in curriculum without change in the attitude of the teachers who acts as implementers and assessors of curriculum would not bring about meaningful educational innovation. Supervisors are relenting and rely on "the old activities provided by them" without reasoning and research development. According to Sergiovanni and Robert (2002) when teachers have access to a high-quality curriculum, teaching improves, and teachers help one another, leading to improvements in instructional quality. Supervision of institution with quality curriculum contributes to higher level and great performance of the student. Hence, it becomes gateway to improve learning activities.
- ***Poor professional development programme supervisions***: professional development is very important in educational sectors. Both academic and administrative units of an institution require developing themselves. Supervisors have to organize orientation programme for the subordinates in order to minimize turbulence facing in the task of supervision most especially in technology advancement and others.

Major Flaws to Supervision in Schools



Prospects to the Challenges Facing Supervision for Excellent Achievement

Effective supervision has a definite role to play in the over-all interest of an excellent institution which is mainly attached to committed, excellent and competent supervisors, as well as glowing equipped institutions and good instructors. Besides, supervision is an important tool towards the achievement of excellence through efficient and committed school leaders that can maintain excellent in students and staff performance to meet the society needs. Both profiteering and non-profiteering institutions have customers who are always demanding and hence, schools need to satisfy them because they determine the future of institution (Andreas, 2002; Lasisi, 2010; Lasisi and Hairuddin, 2010).

Thus, strategic planning is managerial tool needs by the effective supervisor that fit in dealing with any rising turbulent and other challenges confronting educational environment (Preedy, 1997). Bolan, (2002) in his recent research done shows that through professional development, a strategy should be used by the school leaders which is an essential part to improve the school and learning performances. To

achieve the strategies of supervision, strategic planning process should be considered.

In utilizing the strategy, the supervisor need to contemplate on some questions of "what, how, why, when" (Lasisi and Hairuddin, 2010) to supervise. They will enable the supervisor share ideas, procedures and evaluating and develop the curriculum, developing the materials and procedures to implement the curriculum, planning for workshop, research, in-service education, projects development.

This process involves;

1. ***Establishment of Supervision vision and mission***: identifying what is supervision; define the vision and mission of supervision, why is supervision involved.
2. ***Identifies the outcome and alternatives in supervision***: what will be the outcome of supervision, what are the alternatives in supervision.
3. ***Implementations of Supervision plans***: how to implement the action plan in supervision and benefit of the supervision for evaluation by the external environment.

CONCLUSION

Supervision must be viewed as developmental if schools are to become excellent. Supervision must not only respond to current teacher performance or administrative unit, but also encourage greater involvement, independent thinking, and collective action by teachers and human resources. The first order of task for supervision is to explore deeply and build the staff into a team, in order, to improve the institution beyond. Supervisor has to work with staff to create a professional togetherness through establishment of professional development programme that will cater for advancement of the staffs. The staffs must share a common purpose for their instruction and they must have confidence in delivering so that their collective action will make a difference in their students' lives and school targets in general.

Moreover, when acquire knowledge of controlling a school to the extent of excellent and effectiveness. Supervisor's task is to set the staff into work and improves learning activities. Using such knowledge in school demands skill and commitment. Skill and practice flow from knowledge. We have seen that the research on school excellence converges on the concept of a cause beyond oneself or a belief in collective action. To use that knowledge, a supervisor needs further understanding about technical knowhow in teaching methods and the teaching profession to understanding why such supervision requires in educational management.

As lack of thorough supervision manifests in our institutions today, strategic planning practice is prospect required; institutional stakeholders and administrators to tackle the challenges in school supervision. Let all the school supervisors, administrators and staff have knowledge of strategic planning in order to solve the challenges confronting the task of supervisions.

In other words, the most significant method requires to achieving excellent institution is to possess supervision strategy. The strategy must be able to identifies what is supervision, define the vision and mission of supervision, why is supervision involve, what will be the outcome of supervision, what are the alternatives in supervision, how to implement the action plan in supervision and benefit of the supervision for evaluation by the external environment. Thus, 'without strategy no supervision', 'without supervision no excellent institution'

ACKNOWLEDGEMENTS

Author would like to acknowledge the used authors in this article. Also, I am grateful to the authority of International Islamic School, IIUM, Malaysia that given me the opportunity to carried out this research and for successful of this work.

Finally, my thanks due to Rector and other constitutional officers, the Lecturers and students of International Islamic University Malaysia and Institute of Education, Research management, Library management and other advisers for successful published of this work

REFERENCES

[1] Andreas, T. & Petros, P. (2002). "Strategic planning and education: the case of Cypus", *The International Journal of Educational Management*, vol16 no. 1, p 6-17, MCB UP limited, 0951-354X, http://www.emeraldinsight.com/ 0951-354X.htm Retrieved on 15th Nov, 2009.

[2] Bernstein, E., (2004). What teacher evaluation should know and be able to do: A commentary. NAASP Bulletin, 88, p80-88. In Glickman, C. D., Gordon, S. P., & Ross-Gordon, J. M., (2007). *Supervision and instructional leadership a developmental approach*, Boston: Pearson Education, Inc. p. 8

[3] Bolan, (2002). professional development and professionalism in David M., al et, (2005). *Creating a learning school.* p. 63, London: Paul Chapman Publishing

[4] Grigsby, B., Schumaker, G., Deckman, J., & Simieou, (2010). A principles' dilemma: Instructional leader or manager. Academic Leadership 8(3), 1-5. In Key Note address, Omar Abdull Kareem, (2010). Teacher capacity building in teaching and learning: the changing role of school leadership, Presented at 2nd

international Management Educational Conference (iMEC 2010) KL: Malacca

[5] Johnson, J. A., Collins, H. W., Dupuis, V. L., and Johansen, J. H. (1973). *Foundations of American education.* Boston: Allyn and Bacon. p. 20

[6] Khaliq Ahmad (2009). *Management from an Islamic Perspective*. Kuala Lumpur: Prentice Hall. p. 41-42.

[7] Lasisi, Abass Ayodele, & Hairuddin Bin Mohd Ali (2010). Surveying the practice of strategic planning for school excellence, *International Business Education Journal*; Article presented at 2nd International Management Educational Conference (iMEC2010), KL http://fpe.upsi.edu.my/imec2010

[8] Peter, F. Oliva & George E. Pawlas (2004) *Supervision for Todays's Schools*. Hoboken: John Wiley & sons, Inc. p.26

[9] Lasisi, Abass Ayodele (2010) *Surveying the practice of strategic planning for school excellence. (*Master thesis), Kuala Lumpur: Institute of Education, International Islamic University, Malaysia.

[10] Omar Abdull Kareem, (2010). Teacher capacity building in teaching and learning: the changing role of school leadership, Key note address presented at 2nd international Management Educational Conference (iMEC 2010) KL: Malacca

[11] Preedy, M. et al (1997). *Educational management: strategy, quality, and resources,* Buckingham: Open University Press.

[12] Sergiovanni, T. J, & Robert, J. S. (2002). *Supervision: a redefinition*, NY: McGraw-Hill

POSTER

BUSINESS AND ECONOMICS

Effects of Celebrity Credibility and Advertiser Credibility on Advertising Effectiveness: The Moderating Role of Celebrity Adoration

Mazzini Muda[1,*], Associate Professor Dr. Rosidah Musa[2] and Dr. Lennora Putit[3]
[123]Faculty of Business, Management, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia
*mazzinim@salam.uitm.edu.my

Abstract
Endorser and advertiser are two sources of credibility in advertising. Endorser credibility has been widely studied and documented, while advertiser credibility, or the reputation of the company, has received little attention. The objective of this paper is to investigate the influence of both sources of credibility on advertising effectiveness. Survey design via self-administered questionnaire will be used to collect data. Findings from the study are expected to extend the literature on source credibility in advertising and guide practitioners on development of creative advertisements.

Keywords
Endorser credibility, advertiser credibility, advertising effectiveness, celebrity adoration

INTRODUCTION

Advertising environment is increasingly becoming cluttered. In order to make their ads stand out, many advertisers resort to hiring celebrities to endorse their brands in the advertisements. This is because celebrities are perceived to be credible source of communication. Not only celebrities can attract the attention of consumers, they also have been found to produce more positive attitude changes toward the position advocated and to induce more behavioral changes than other types of endorsers. The endorser or spokesperson as an important source in a company's marketing communications strategy has been widely studied.

On the other hand, another type of source credibility identified in marketing literature-the advertiser credibility- has received little coverage with regards to its impact on advertising effectiveness. Advertiser credibility or "corporate credibility" (Newell & Goldsmith, 2001, p. 235) refers to the extent to which consumers feel that the firm has the knowledge or ability to fulfill its claim and whether the firm can be trusted to tell the truth or not. LaBarbera (1982) predicts that companies with low credibility scores will have problems in creating demand, achieving brand preference and presenting effective ad messages. Very few empirical studies (except for Laferty & Goldsmith, 1999; Goldsmith, Lafferty & Newell, 2001) have examined the combined effects of endorser credibility and advertiser credibility on consumer attitudes toward the ad, attitudes toward the brand and purchase intentions–the three traditional measures of advertising effectiveness. Therefore, this study aims to determine the effects of the combined power of source credibility on consumer response to the advertisement. Moreover, the moderating role of celebrity adoration will also be investigated in this study.

LITERATURE REVIEW

Celebrity Credibility

Source credibility is a term often used to refer to the attributes of the communicator such as expertise, trustworthiness and attractiveness (Belch et al., 1987). A communicator with expertise is more persuasive because he or she posses knowledge, skill or experience. Furthermore, the source also has to be trustworthy, that is honest, ethical and believable. Ohanian (1990) adds attractiveness as another dimension of credibility as attractive people tend to be liked more, and are likely to have a positive influence on the product they advertised. Advertisers have many options for endorser: ordinary people, corporate leaders, experts and celebrities. However, only celebrities have the "stopping power" to draw people attention to the advertisements in a much cluttered media environment. Advertisers believe that a popular celebrity such as a singer, actor, athlete, musician and etc. will favorably influence consumers' attitudes and purchase behavior. Thus, it is hypothesized that:

H1: Celebrity credibility will have a positive impact on attitude toward the advertisement.

Advertiser Credibility

Advertiser credibility is synonymous with "corporate credibility" (Newell & Goldsmith, 2001; Laferty & Goldsmith, 1999; Goldsmith, Lafferty & Newell, 2001) and "company credibility" (LaBarbera, 1982). It is the extent to which a company is perceived as having knowledge and ability to deliver quality products or services and telling the truth in its communications with the consumers. In other words, advertiser credibility refers to the reputation of the company for honesty and expertise. Seems similar to endorser credibility, but Newell and Goldsmith (2001) argue that it is different because advertiser credibility does not possess the dimension of attractiveness. Therefore, this study also conceptualizes advertiser credibility as having only

the dimensions of expertise and trustworthiness. Even though there is little empirical research on advertiser credibility, there were evident to suggest that it is important in producing positive attitude changes toward the ad and the brand as well as influencing purchase intention (Fombrun, 1996). Furthermore, Goldberg and Hartwick (1990) conclude that company with positive reputation would be able to influence consumers to believe and trust their advertising messages. Asian consumers, for instance, would be concerned about the advertiser of the product and whether the company is a socially responsible company (Kotler et al., 2005). Therefore, based on previous literature, this study posits:

H2: Advertiser credibility will have positive impact on attitude toward the advertisement.
H3: Advertiser credibility will have positive impact on purchase intention.
H4: Advertiser credibility will have positive impact on attitude toward the brand.

Advertising Effectiveness

Advertising is effective if it can achieve the objectives set prior to the implementation of the advertising campaign (Shimp, 2008). Usually, the most common way of measuring the effectiveness of advertising campaign is by measuring attitudes, purchase intentions and product beliefs (Solomon, 2007). Researchers commonly use multiattribute attitude models to explain attitudes, intentions and behavior. Fishbein Attitude Theory is a widely used model to measure advertising effectiveness (Fishbein, 1983; Solomon, 2007) as it breaks down the attitude into two separate constructs, attitude toward the ad (AAd) and attitude toward the brand (AB), and purchase intention (PI).

Mckenzie and Lutz (1989) define AAd as "a predisposition to respond in a favorable or unfavorable manner to a particular advertising stimulus during a particular exposure occasion" (p. 47). AAd may contain both, affective reaction (ad-created feelings of happiness) and evaluation (an ad's credibility or informativeness) (Baker and Lutz (1988). Emotionally, consumers form AAd by consciously processing the executional elements found in ad such as endorser, presentation style, colors and etcetera. Therefore, consumers may emotionally respond to the celebrity in the advertisement.

Attitude toward the brand (AB) attempts to influence brand choice by engendering favorable consumer attitudes toward the advertised brand (Shimp, 1981). This concept is achieved by structuring ads to influence consumers' beliefs and evaluations regarding the favorable consequences of consuming the brand. AB includes beliefs formed from the ad, brand attribute information and inference based on ad picture contents (Gardner, 1985; Mitchell and Olson, 1981). Biehal et al. (1992) found that AB mediates the impact of the AAd on intentions in two ways, directly and indirectly. Directly, AAd and AB have separate influences on consumers' intention. Indirectly, AAd has an impact on AB; then AB affects the consumers' intentions. Thus, AB which includes beliefs formed from brand attribute information and inferences based on ad picture contents (Mitchell and Olson, 1981) mediates the impact of AAd on intention. Our next hypotheses are as follows:

H5: Attitude toward the ad positively influence attitude toward the brand.
H6: Attitude toward the ad positively influence purchase intention.

Intentions are "type of judgments about how in the present context, a consumer will behave towards a particular brand" (Biehal et al., 1992, p. 25). Intentions may be based on processing all the relevant and available brand information. A close relationship between intentions and choice may not always occur; consumers may make choices without completely processing all brand information (Biehal et al., 1992). Consumers may not even form overall evaluations/intentions either, but they may form attitudes toward the brand without making choices (Biehal et al., 1992). Woodside and Taylor (1978) hypothesize that the more the product is advertised, the higher the perceived quality it has and the more it will be consumed. The more advertised the brands are, the more easily recognizable they are, thus leading to greater consumption. Woodside and Taylor (1978) discover that consumers viewed products that are nationally advertised to be higher in quality and therefore its purchase intention increases. By creating greater confidence in the quality of the product, advertising may be more directly related to the purchase decision. Thus, we submit another hypothesis:

H7: Attitude toward the brand positively influence purchase intention.

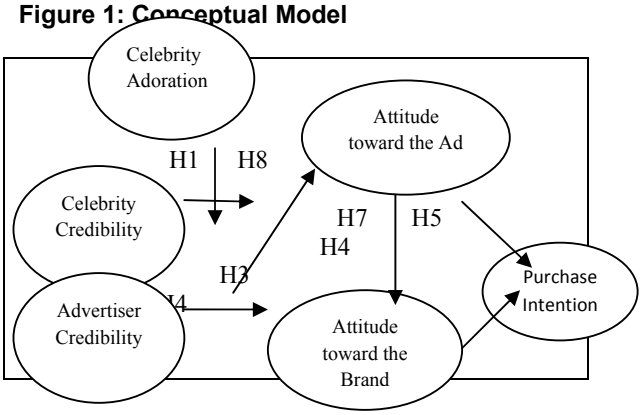
Celebrity Adoration

Celebrities are popular individuals, who are constantly depicted in the mass media and attract attention. The proliferation of entertainment media worldwide has increased the exposure of people to entertainment celebrities and has given them a powerful influence over people, especially adolescents (Brown & Basil, 1995). Celebrity adoration is defined as a feeling of profound love and admiration toward a celebrity (www.online.dictionary.com). The involvement with celebrities refers to the degree to which an individual actively participates in decoding a media message on the celebrities (Brown & Basil, 1995), including celebrities endorsing product in advertisement. In the case of celebrity-endorsed advertisements, it is logical to assume that consumers who identify with media celebrities will look forward to seeing celebrities in various media including advertising. Therefore, we can hypothesize this:

H8: Celebrity adoration will moderate the relationship between celebrity credibility and attitude toward the ad.

Figure 1 presents a proposed theoretical framework and hypothesized relationships among the constructs. A considerable amount of research has illustrated the sequential path of influence from AAd to AB, which subsequently can impact attitude toward purchase intention (Lafferty, Goldsmith & Newell, 2002; MacKenzie & Lutz, 1989; MacKenzie, Lutz & Belch, 1986; Mitchell & Olson, 1981).

Figure 1: Conceptual Model



METHODOLOGY

This study adopts a quantitative methodology via a cross-sectional survey. A self-administered questionnaire will be distributed to 600 respondents by drop-and-collect method. Due to the length of most doctoral questionnaires, the dropped off method is more suitable because respondents are given more time to concentrate on the questionnaire in private and respond to it whenever it is convenient to them. As stipulated population units are unavailable, alternatively quota sampling approach is chosen. The sampling frame targeted comprised of three major ethnic groups in Malaysia within the approximate ratio of 60:25:15 amongst Malays, Chinese and Indian respectively, based on Malaysia total population census in 2008. In addition, a relevant proportion of age group is also targeted amongst these target samples. Most measurement instruments are adapted from previous literature. However, scales will be tested for reliability, purified using Cronbach's alpha and later assessed for convergent and discriminate validity. To validate the measurement model, structural equation modeling (SEM) technique will be used.

CONCLUSION

This paper outlines a proposed doctoral research involving the use of celebrity endorser in advertising. Other than this source, another not-so-popularly research source in communication message - the company sponsoring the advertisement - is also investigated. Studies have shown that both, endorser and advertiser credibility are important determinants of consumers' attitudinal and behavioral changes. As most models in advertising originate from the Western cultures, this study will contribute to the application of those models into Eastern cultures. While in western cultures, people tend to hero-worship and idolize their celebrities, people here especially the Muslims are taught instead to take pious people amongst them as role models. For that reason, we may be surprised with different results.

REFERENCES

[1] Baker, M. J., & Lutz, R. (1988). The relevance-accessibility model of advertising effectiveness. In Hecker, S., Stewart, D. W. (Eds). *Nonverbal Communication in Advertising*, Lexington, MA: Lexington Books, 59-84.

[2] Belch, G.E., and Belch, M.A. (2004). *Advertising and promotion: An IntegratedMarketing Communications Perspective* (6th Ed), McGraw-Hill, New York, NY.

[3] Belch, G.E., Belch, M.A., and Villarreal, A. (1987). Effects of advertising communications: review of research. *Research in Marketing*. Greenwich, CT: JAI press, 9, 59-117.

[4] Biehal, G., Stephens, D., and Curlo, D. (1992). Attitude toward the ad and brand choice. Journal of Advertising, 21(3), 19-36.

[5] Brown, W.J., and Basil, M.D. (1995). Media celebrities and public health: responses to 'Magic Johnson's HIV disclosure and its impact on AIDS risk and high-risk behavior. *Health Communication*, 7(4), 345-370.

[6] Fishbein, M. (1983). An investigation of the relationship between beliefs about an object and the attitude toward the object. *Human Relations, 16*, 233-240.

[7] Fombrun, C. J. (1996). *Reputation: Realizing Value from Corporate Image*, Harvard Business School press, Boston, MA.

[8] Gardner, M. P. (1985). Does attitude toward the ad affect brand attitude under a brand evaluation set? *Journal of Marketing Research*, 22(2), 192 198.

[9] Goldberg, M.E., and Hartwick, J. (1990). The effects of advertiser reputation and extremity of advertising claim on advertising effectiveness. Journal of Consumer Research, 25(May), 172-179.

[10] Goldsmith, R. E., Lafferty, B.A., and Newell, S.J. (2000a). The impact of corporate credibility and celebrity credibility on consumer reaction to advertisements and brands. *Journal of Advertising*, 29(3), 43-54.

[11] Kotler, P., Keller, K.L., Ang, S.H., and Leong, S.M. (2009). Marketing Management: An Asian Perspective (5 th Ed.) Prentice Hall.

[12] LaBarbera, P.A. (1982). Overcoming a no-reputation liability through documentation and advertising regulation. *Journal of Marketing Research*, 19, 223-8.

[13] Lafferty, B.A. and Goldsmith, R.E. (1999). Corporate credibility's role in consumers' attitudes and purchase intentions when a high versus low credibility endorser is used in the ad. Journal of Business research, 44(), 109-116.

[14] Newell, S. J. and Goldsmith, R. E. (2001). The development of a scale to measure perceived corporate credibility. *Journal of Business Research*, 52(3), 15-24.

[15] Ohanian, R. (1990). Construction and validation of a scale to measure celebrity endorsers' perceived expertise, trustworthiness, and attractiveness. *Journal of Advertising*, 19(3), 39-52.

[16] MacKenzie, S.B., and Lutz, R.J. (1989). An empirical examination of the structural antecedents of attitude toward the ad in an advertising pretesting context. *Journal of Marketing*, 53(April), 48-65.

[17] MacKenzie, S. B., Lutz, R. J. & Belch, G. E. (1986). The role of attitude toward the ad as a mediator of advertising effectiveness: A test of competing explanations. *Journal of Marketing Research, 23*, 130-143.

[18] Mitchell, a. A., & Olson, J. C. (1981). Are product attitude beliefs the only mediator of advertising effects on brand attitude? *Journal of Marketing Research,* 18(3), 318-332.

[19] Shimp, T. A. (1981). Attitude toward the ad as a mediator of consumer brand choice. *Journal of Advertising*, 10(2), 9-48.

[20] Shimp, T. A. (2008). Integrated marketing communications in advertising and promotion. Mason, OH: Thomson South-Western.

[21] Woodside, A.G., and Taylor, J.L. (1978).Consumer purchase intentions and perceptions of product quality and national advertising. Journal of Advertising, 7, 48-51.

A Conceptual Framework on Performance Measurement System: Using Sustainable Balanced Scorecard to Measure Healthcare Service Quality at Kuala Lumpur Based Islamic Hospital

Ahmad Ezainuddin Badarudin[1]*, Assoc. Prof. Dr. Zaini Abdullah[1] and Assoc. Prof. Dr. Azizan Abdullah[1]

[1] Business Management Faculty, MARA University of Technology, Shah Alam, Selangor D.E.

* ezai63@gmail.com

Abstract

The main issue for discussion of this paper is the introduction the Sustainable Balanced Scorecard as performance measurement systems at Kuala Lumpur based Islamic hospitals. After a literature search was done, a conceptual framework of performance measurement systems in order to explain the abovementioned subject matters which add to the already established four Balanced Scorecard perspectives namely; learning and growth, business process capabilities, customer satisfaction, and financial performance. It is found out that, performance measurement systems using Balanced Scorecard is highly likely to be used to measure healthcare service quality at Kuala Lumpur based Islamic private hospitals with the perspective of sustainable development factors added on.

Keywords

Performance measurement system, Islamic hospital, Balanced Scorecard, Sustainable Balanced Scorecard, sustainable development factors.

INTRODUCTION

What is performance measurement system?

Performance measurement system (pms) can be defined as the information system which is at the heart of performance measurement process and of critical importance to the effective and efficient functioning of the organisation [1].

Objectives of performance measurement system

The main objective of pms is integrating organizational activities across various managerial levels and functions [2]. Pms focuses to "integrate organizational activities across various managerial levels and functions"[3]. Hronec suggests the necessity for integration of pms as a "tool for balancing multiple measures (cost, quality, and time) across multiple levels (organization, processes and people) [4].

METHODOLOGY

An extensive review on related works and findings to find the knowledge gap in the subject matter of pms at hospitals and healthcare in general with special focus in Islamic hospitals.

Past literatures were reviewed in the form of dissertations, academic journals either electronic or otherwise. Personnel communication was conducted with various experts in the Malaysian healthcare industry at various venues seeking further clarification and more information on the subject matter.

FINDINGS

Performance measurement system: the story so far

It is stressed that accounting measures which is represented the 'outcomes' of activities alone are not adequate as a pms in a very rapid changing business environment. The need to monitor drivers of the measures apart the 'outcomes' of activities became very important [5]. Additionally, Malina stressed that there are very few studies which actually testing the relationship between financial and non financial indicators to build a pms model [6].

Performance measurement system in the healthcare industry

The health care industry has been emphasizing too much on the financial measures of performance in response to cost pressures which may lead to a dangerous impediment to creating future economics value [7]. As a result, given the inherent limitations of financial measures (they reflect historical performance, are highly aggregated, and may lead to a short term bias), many companies have sought to supplement financial measures with non financial measures [8].

Balanced Scorecard

The balanced scorecard has been used as pms tool at various hospitals in many different countries as stated in table 1.

Table 1: Balanced Scorecard as performance measurement system at separate hospitals with various modified perspectives

Name of hospitals	Modified perspectives
Duke Children's Hospital Balanced Scorecard, USA	Research, education and teaching
Falls Memorial Hospital, International Falls, USA	Staff and clinicians Quality Patients and community Business and development
Bridgeport Hospital, USA	Volume and market share growth Quality improvement Process improvement Organisation health
Royal Ottawa Hospital, USA	Innovation and growth Research Care and service Systems integration
Mayo Clinic, USA	Clinical productivity and efficiency Mutual respect and diversity Social commitment External environmental assessment Patients characteristics
Royal Brisbane & Women's Hospital, AU	Patient, clients and staff Learning and innovation Customer/patient Process/productivity

Adapted from [9]

The present performance measurement system used at Kuala Lumpur Islamic private hospital

The presently and most commonly used pms tools as at the Islamic hospitals are the financial ratios and sometimes the customer satisfaction report [Yusni, personal communication, January 4, 2007.). This is added by the fact that, the Malaysian version of the Patient Charter has not been effective and lacks 'teeth', as it lacks the backing of the relevant machinery and lacks the platform to health matters [10].

The Balanced Scorecard concept

Kaplan and Norton (1992) stressed that the concept of the Balanced Scorecard (BSC) was developed in the early 1990s as a new approach to performance measurement due to problems of short-termism and past orientation in management accounting. The BSC concept was based on the assumption that the efficient use of investment capital is no longer the sole determinant for competitive advantages, but increasingly soft factors such as intellectual capital, knowledge creation or excellent customer orientation become more important.

As the result, they suggested a new performance measurement approach that focuses on corporate strategy in four perspectives [11], [12], [13].

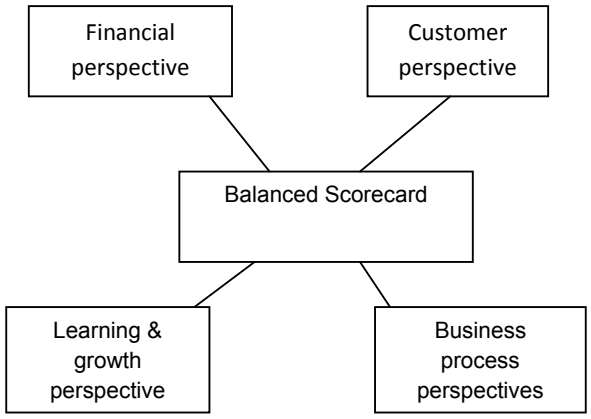


Figure 1: The Balanced Scorecard
Source: Kaplan and Norton,1992

The BSC's four perspectives can be characterized briefly as follows [12].

- The financial perspective indicates whether the transformation of a strategy leads to improved economic success. Thus, the financial measures has two roles. Role number one, the financial perspectives define the financial performance a strategy is expected to achieve, and role number two they also, are the endpoint of cause and effect relationships referring to the other BSC perspectives.
- The customer perspective of BSC defines the customer or market segments in which the business competes. By means of appropriate strategic objectives, measure, targets and initiatives the customer value proposition is represented in the customer perspective through which the firm or business unit wants to achieve a competitive advantage in the envisaged market segments. The internal process perspective identifies those internal business processes that enable the firm to meet the expectations of customers in the target markets and those of the shareholders.
- And last but not least, the learning and growth perspective of BSC describes the infrastructure necessary for the achievement of the objectives of the other three perspectives. The most important areas are qualification,motivation and goal orientation of employees, and information systems.

The sustainable concept

Conceptually, sustainability management with
BSC seeks to address the problem of corporate contributions to sustainability in an integrative way.

Figge *et al*. highlighted that the sustainability concepts for companies is to contribute to sustainable development, whereby it is desirable that corporate performance improvements in all three dimensions of sustainability – economic, environmental and social at the same period of time [13] This is apart from the four perspectives of the conventional BSC which are listed as learning and growth, business process, customer satisfaction, and financial performance[14].
Such an approach to sustainability management aims at a simultaneous achievement of ecological, social and economic goals [14].

Sustainable Balanced Scorecard: an integration of the sustainable concept with the Balanced Scorecard

There are basically three ways to integrate environmental and social aspects in the BSC .First, environmental and social aspects can be integrated in the existing four standard perspectives. Secondly, an additional perspective can be added to take environmental and social aspects into account. And number three, a specific environmental and or social scorecard can be formulated [15], [16].

Sustainable Balanced Scorecard as performance measurement system at Malaysian private hospitals

Figge *et al.* argued that that Sustainable Balanced Scorecard provided sufficient potential to overcome shortcoming in the sustainability management which focuses on more qualitative aspects (social and environmental aspects) [17].
Yet, too few researches have been done on using the Balanced Scorecard as performance measurement tool in measuring health care service quality in hospitals' environment. Volker et al. highlighted that hospitals have been slow to develop and implement formal performance and productivity measured systems. The primary problems that inhibited hospitals from making greater progress in this area are a culture, organization, and managerial practices that are inconsistent with competitive business, including operation practices that are not cost driven [18].
Some specific reasons why hospitals have not been active in this area include the following; many hospitals boards are composed of members lacking experience in competitive environment, lack of employee participations ,particularly among doctors, and because many individuals regards hospital services as intangible and impossible to measure. Medical staff relations and quality of care are important attributes of hospital performance that can be difficult to measure, interpret, and compare with other healthcare organizations [19].

CONCEPTUAL FRAMEWORK

The proposed conceptual framework for this study is shown in figure 1. It can be noted that, the researcher has proposed to add the perspective of sustainable development factor by integration with the existing four standard perspectives.

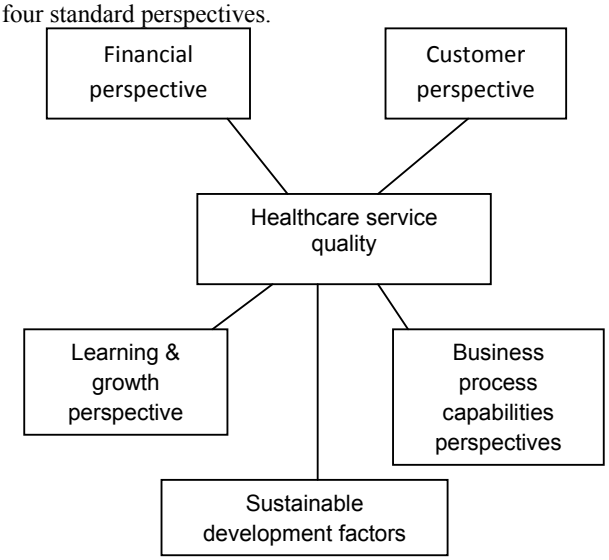


Figure 1: The proposed Sustainable Balanced Scorecard as performance measurement system to measure healthcare service quality at Malaysian private hospitals
Source: this research

Proposed research question

The guiding research question for this particular paper is listed as, "Is there any relationship between sustainable development factors and healthcare service quality at the Kuala Lumpur based Islamic private hospital?"

CONCLUSION

With the gaps found in both literature reviews and personal communication with regards to pms being used at Kuala Lumpur based Islamic hospitals indicates that there is no research done on the usage of Balanced Scorecard and the Sustainable Balanced Scorecard. Therefore, it is recommended that the conceptual framework for a Sustainable Balanced Scorecard is highly viable.

ACKNOWLEDGEMENTS

The authors would like to express their gratitude to the member hospitals of Konsortium Hospital Islam Malaysia(KHIM) staff, and patients for making this study possible.

REFERENCES

[1] Bititci, U.S., Turner, T. and Begemann, C., "Integrated performance measurement systems: a development guide", *International Journal of Operations & Production Management*, Vol. 17 No. 5, pp. 522-34, 1997.
[2] Hronec, S.M., "*Vital signs-Using quality, time and cost performance measurements to chart your company's future*", Amocon, New York, NY, 1993.

[3] Bernard Marr, Gianni Schiuma, "Business performance measurement – past, present and future", *Management Decision*, Vol. 41 Iss: 8, pp.680 – 687, 2003.

[4] McNair, C.J., Mosconi W.J., Norris T.F, Beyond the Bottom Line. *Measuring world class performance*, Irwin, IL.,1989.

[5] A. Neely, *Business Performance Measurement: Theory and Practice*, Cambridge, Cambridge University Press, 2002.

[6] Malina, Mary A. Selto, Frank H.,"Communicating and Controlling Strategy:An Empirical Study of the Effectiveness of the Balanced Scorecard", *Journal of Management Accounting Research,* Vol. 13, pp. 47-91,2001.

[7] Gurd, B and Gao, T.,"Lives in the balance: an analysis of the balanced scorecard(BSC) in health care organizations", *International Journal of Productivity and Performance Management*, Vol.57 No.1, pp. 6-21,2008.

[8] Malaysian medical resources (December,2004). "*The patients charter"*.Retrieved 3 October 2010,from http://medicine.com.my

[9] Kaplan, R. S., and D. P. Norton, "Transforming the balanced scorecard from performance measurement to strategic management: Part I*", Accounting Horizons,*pp. 87-104,March, 2001.

[10] Kaplan, R. S. and D. P. Norton,, "Why does business need a balanced scorecard?", *Journal of Cost Management"*, pp. 5-10, May/June.1997).

[11] Kaplan, R. S. and D. P. Norton,", The balanced scorecard - Measures that drive performance", *Harvard Business Review*,pp.71-79, January-February,1992.

[12] Bruce Gurd., Remaining consistent with method? An analysis of grounded theory research in accounting", *Qualitative Research in Accounting & Management*. Vol. 5 Iss: 2, pp.122 – 138, 2008.

[13] Figge F, Schaltegger S., "*What is 'Stakeholder Value? Developing a Catchphrase into a Benchmarking Tool*", University of Lueneburg and Bank Pictet in association with UNEP, Luneburg,2000.

[14] Zelman, W.N., G.H. Pink and C.B. Matthias, "Use of the Balanced Scorecard in Health Care", *Journal of Health Care Finance* 29(4): 1–16, 2003.

[15] Kaplan R, Norton D.,"The Balanced Scorecard – measures that drive performance", *Harvard Business Review,* Jan-Feb: 71–79, 1992.

[16] Kaplan R, Norton D.,"*The Strategy-Focused Organization: how Balanced Scorecard Companies Thrive in the New Business Environment",*Harvard Business School Press: Boston, MA, 2001.

[17] Figge F, Hahn T, Schaltegger S., Wagner M.,"The Sustainability Balanced Scorecard – a tool for value-oriented sustainability management in strategy focused organizations", in *2001 Eco-Management and Auditing Conference*, 2001, pp. 83–90.

[18] Figge F., Schaltegger S., "*What is 'Stakeholder Value? Developing a Catchphrase into a Benchmarking Tool*", University of Lueneburg and Bank Pictet in association with UNEP, Luneburg, 2000.

[19] Epstein MJ., "*Measuring Corporate Environmental Performance: Best Practices for Costing and Managing an Effective Environmental Strategy"*. Irwin: Chicago, IL., 1996.

Financing Through the Maxim *Al-Ghonm Bi Al-Ghorm:* An Analysis of Factors Contributing to the Acceptance of The MFC by SMEs

Rozita @ Uji Mohammed, Remali Yusoff and Rosita Chong Abdullah
Universiti Malaysia Sabah
uji3008@yahoo.com

Abstract
In this paper, we discuss on findings based on four research objectives: (i) to identify factors that could contribute to the acceptance of the *Musharakah* Financing Concept (MFC) by Small and medium-sized enterprises (SMEs), (ii) to identify whether there is a 'finance gap' within the SME sector, (iii) to determine the attitude of the SMEs in Kota Kinabalu City Centre (KKCC) towards the MFC, and (iv) to identify the extent of the involvement of Islamic Banks (IBs) at the branch level in the *Musharakah* financing contract.

INTRODUCTION

Musharakah (مشاركة) is a word of Arabic origin, which literally means sharing (IBFIM, 2008). In the context of business, it means a partnership where two or more partners (*mushariks*) including the IBs combine their capital, expertise and/or labour to take on a venture, sharing the profits, and enjoying similar rights and liabilities (Al-Harran, 1995; Nik Yusoff, 2002). Its legal maxim *al-ghonm bi al-ghorm* (الغنم بالغرم) shows purity in its meaning, where the entitlement to the return is always related to the risk. Haron *et al.* (1994) claimed that it is essential to know the degree to which various product characteristics are important and how these factors influence customers' bank selection criteria. According to Cowdell and Farrance (1995), as an enterprise, SME also needs to consider not only the banking factors, but also personal and business factors when dealing with a bank. Hence, it is considered timely to determine factors contributing to the acceptance of the MFC by SMEs.

FACTORS CONTRIBUTING TO THE ACCEPTANCE OF THE MFC BY SMEs

Based on the bivariate analysis done on 40 factors or variables, there are five factors that can be considered as having strong effects on the acceptance of the MFC by SMEs, followed by 23 factors, which are considered as moderate and 12 factors which are weak. However, there are other factors that can be considered as strong under 'the rule of thumb'[12] such as B3_FAMILIAR_CONCEPT, C3_RELIGION, C4_RACE, E5_PURPOSE_FIN, and E6_CONSTRAINT_GET_LOANS. The same situation also goes for one independent variable (IV) i.e. C5_EDUCATION that was considered as having weak association with the dependent variable (DV) i.e. A18_ACCEPT_CONCEPT after being tested using bivariate analysis, but under the rule of thumb, it actually had a strong effect on the acceptance of the MFC. Thus, the factors that can be considered as strong contributors to the acceptance of the MFC by SMEs can be rewritten as in table 1 below. The table is constructed after considering the results derived from the bivariate analysis and the rule of thumb. Hence, there are 11 IVs that strongly contribute to the acceptance of the MFC.

Table 1. Factors contributing to the acceptance of the MFC

No.	Factors (IVs)	Strength	Measure	Probability
1.	A6_KNOWLEDGE ABLE_TRAINED	Strong	Bivariate analysis[a]	Significant[c]
2.	A11_REPUTATION _IMAGE			
3.	A19 ACCEPT IF UNDERSTAND			
4.	A20_MUSHARAK AH_DESIGN			
5.	A21_PLS_ PRINCIPLE			
6.	B3_FAMILIAR_ CONCEPT	Strong	Rule of thumb[b]	Significant[c]
7.	C3_RELIGION			
8.	C4_RACE			
9.	C5_EDUCATION	Strong	Rule of thumb[b]	Insignificant[d]
10.	E5_PURPOSE_FIN			
11.	E6_CONSTRAINT_ GET_LOANS			

Note:
[a] Bivariate analysis used Somer's d[13] to examine the correlation between two ordinal variables.
[b] The rule of thumb refers to the '10 percentage point rule'.
[c] Significant means the relationships between the DV and the IVs can be generalized from the sample to the population.
[d] Insignificant means the relationships between the DV and the IVs cannot be generalized from the sample to the population.

FINANCE GAP WITHIN SMEs SECTOR

Based on the profile analysis done on SMEs and IBs, it was found that the two main players possessed traits or

[12] Sometimes, a bivariate analysis produces unsatisfactory values of association between variables. However, by using the rule of thumb, it can be verified that there is a worthy association between variables. For instance, if the percentage point difference is 10 per cent or more, the relationship between variables is said to be 'worthy', whether it is strong, moderate, or weak depending on the amount of differences between the percentage columns of each case (Babbie *et al*., 2003).

[13] Somers' d is a good choice for examining the association of two ordinal variables, because it has a 'Proportionate Reduction of Error', which means two variables are associated when information about one variable can help to improve the prediction of other variable.

characteristics that could bring them to the 'grey zone', area of unsure about something or somebody. Furthermore, these traits caused them to conduct decision making with limited sources of information and form the wrong perception about the observed matter(s) i.e. information asymmetry, which in turn put them into a risky situation i.e. moral hazard.

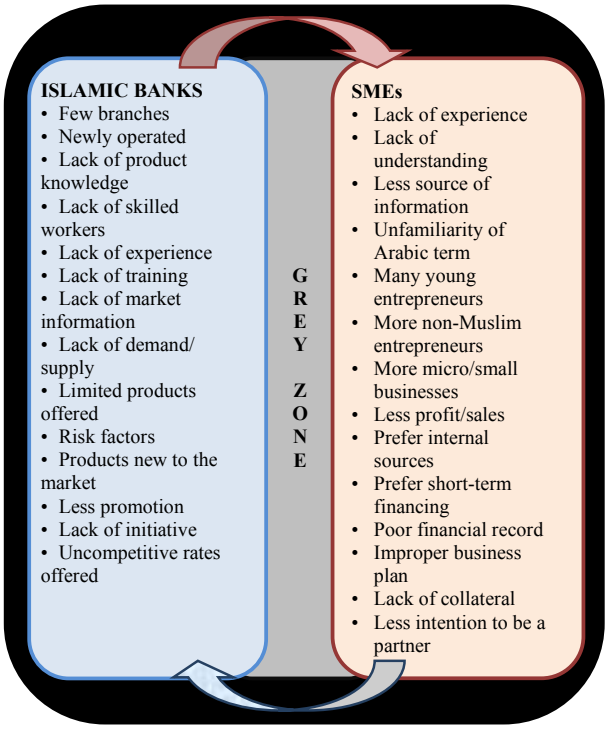


Diagram 1. Finance gap within SME sector

Based on diagram 1, there are 14 traits that are contributed by IBs to the grey zone including: (i) most IBs only have few branches and these are insufficient to serve all SMEs operating in the Sabah regions, (ii) most of the IBs are new and in turn are not well known to the SMEs, (iii) most of the staff of IBs lack the knowledge of equity-based financing (EBF), particularly *Musharakah* and other financial products that are rarely heard in the market such as *Istisna* and *Salam*, (iv) most of IBs lack skilled workers, especially to handle complicated products such as the MFC and other unwell-known products, (v) most of IBs, mainly at the branch level lack the experience in handling the complicated products in comparison to their headquarters, (vi) most IBs at the branch level only depend on their in-house training programs, which are conducted by their human resource (HR) departments, (vii) most IBs do not have sufficient market information and are unsure about the demographic background of SMEs, (viii) poor demand and inadequate provision of MFC at the branch level had caused the same product lines to lack aggressive promotion to the SME market, (ix) most IBs at the branch level offer only limited types of financial products, (x) besides being new to the Sabah market, most IBs do not aggressively involve in MFC due to the risk factors, (xi) the only products that are popular and well-demanded by SMEs are offered widely compared to the products that are new to the market, (xii) most IBs only promotes debt-based financing (DBF) and conduct less promotion for EBF, (xiii) most IBs at the branch level lack the initiatives to search for new markets and business ventures with SMEs, and finally, (xiv) most IBs offer competitive rates only to the selected SMEs, not all.

However, the issue of 'finance gap' cannot be solely caused by the IBs. The SME sector is also responsible for the existence of the gap, which is created between the SMEs and the IBs. From the perspective of SMEs, there are also 14 traits that are believed to have encouraged the existence of a 'finance gap' within their market including: (i) most SMEs lack the experience in dealing with the Islamic banking and financial products, (ii) most of SMEs lack the understanding about the operations of the Islamic banking, the products and services offered to them, and the *Shariah* laws as imposed by the IBs, (iii) there are very few sources of information with regard to the financing products that are suitable for SMEs, (iv) most SME owners find it difficult to pronounce and are unfamiliar with the Arabic terms used in the Islamic banking products, (v) most of the SME owners are young and possess secondary school qualifications only, and their insufficient knowledge about the financing facilities available in the market has created a distance between them and the IBs, (vi) there are more non-Muslim entrepreneurs compared to Muslim entrepreneurs and this situation has contributed to the poor acceptance of the MFC, (vii) there are more micro and small businesses in the market, which have limited abilities and opportunities to borrow money or apply for loans from the BIs, in turn creating a small demand for financial products in the market, (viii) less profit and sales due to the type or size of the business which affect the capability of SMEs to obtain loans from the IBs, (ix) the sources of funds for running the daily operations and other business activities are still highly dependent on the internal sources, which are faster and cheaper in terms of pre-payments, (x) SMEs also prefer short-term financing compared to the medium and long-term financing, and since most of the EBF products are longer in terms of the duration, *Musharakah* is seen unsuitable for their financial needs, (xi) poor financial record of SMEs hampers their possibility to become the borrowers or business partners of the IBs, (xii) most small traders have not been able to prepare a proper business plan that is very important in order to borrow money from a bank or to be a business partner of a bank, (xiii) lack of collateral means most SMEs lack the collateral to be pledged as a back-up when trying to obtain loans from the IBs, and finally, (xiv) the lack of desire to become the business partner of an IB remains if the partnership

under the MFC is not widely accepted among the SMEs and not encouraged aggressively by the government.

THE ATTITUDE OF SMEs TOWARDS MFC

Here, the main idea is to determine either the SMEs in KKCC accept, do not accept, or are unsure about the MFC. It is good to have views from the small traders about this newly perceived concept of financing. Even though the concept is not actually new to the Islamic financial market, but it is relatively new to the SME sector. This situation can be proven by closely examining their financing pattern (SMIDEC, 2005). As discussed earlier, due to the existence of a finance gap, the small traders have been focusing on internal sources such as own savings and properties, family and friends, and non-financial institutions (FIs). Since our government has urged enterprises to do direct investments in order to boost the economy of the country, it is considered timely if MFC can be introduced and highlighted by the IBs with the purpose to attract the attention of SMEs which represent one of the most available investment devices for them to remain prosperous in the competitive market. In order to determine the attitude of SMEs towards MFC, there are a few judgements made based on the analyses done earlier. These analyses include profile analysis, cross-tab analysis based on the rule of thumb, and mean rank analysis. The analysis and findings provide an overall picture with regard to the attitude of the SMEs in KKCC area towards the MFC and are discussed as follows:

Profile Analysis

Diagram 2 shows the level of acceptance of the MFC by SMEs. It can be seen that on average most SMEs accept the MFC. From the diagram, a total of 158 SMEs or 45.2 per cent stated 'agree' and 'strongly agree' to the statement on the acceptance of the concept. A total number of 145 SMEs or 41.4 per cent were unsure about the MFC. This is another impact of the finance gap that needs to be reduced by the IBs. It is clearly illustrated that if they have a better understanding about the concept, then the number of SMEs which chose 'neither agree nor disagree' scale could be reduced from 145 to 89 SMEs or 25.4 per cent. This will in turn, increase the number of SMEs which chose 'agree' and 'strongly agree' from 158 to 234 SMEs or 66.9 per cent (refer to diagram 3).

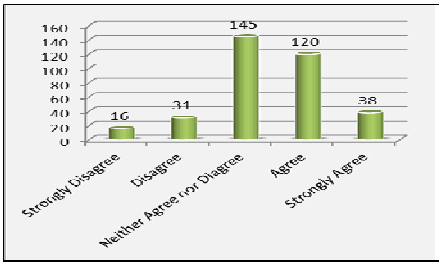


Diagram 2. The Acceptance of the MFC by SMEs

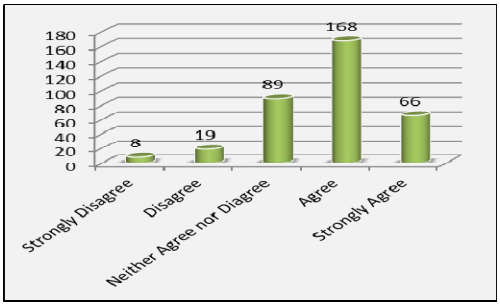


Diagram 3. The Acceptance of the MFC if SMEs understand

Cross-Tabulation based on The Rule of Thumb

Table 1 shows six variables (IVs) that can be considered as having strong relationship with DV. These variables can be further explained as in table 2.

Table 2. The attitude of SMEs towards MFC

Factor (IV)	Findings
B3_FAMILIAR _CONCEPT	The more familiar the respondents are with the Arabic terms used for the Islamic financial products, the more receptive they would be of the MFC. **This is a new variable added to the banking selection study.*
C3_RELIGION	More Muslim entrepreneurs accept the MFC compared to non-Muslim entrepreneurs. This might be due to the lack of knowledge of the *Shariah* laws, particularly about the *halal* and *haram* concepts that are related to the operation of business, the types of business that are allowed to form a 'partnership' venture with IBs, and also the stereotype perception of non-Muslims about the Islamic products that are perceived as only suitable for the Muslim communities. **This finding is in accordance with the studies conducted by Haron et. al (1984) and Zainuddin et. al (2004).*
C4_RACE	The race of entrepreneurs reflects their religions where the majority of Malay entrepreneurs together with other Muslim communities are more receptive of the MFC compared to the other races of non-Muslim communities. **This is a new variable added to the banking selection study.*
C5_ EDUCATION	The lower the level of education of entrepreneurs is, the more willing they are to accept the MFC. On the other hand, the higher their level of education is, the lesser their willingness to accept the MFC. **This finding is in accordance with the studies conducted by Metwally (1996) and Al-Sultan (1999).*
E5_PURPOSE_ FIN	More entrepreneurs go for MFC not during the early stage but, at the intermediate stage which means they need *Musharakah* to meet financing needs such as to expand business and to conduct R&D. **None of the previous study had further explained on this variable.*
E6_ CONSTRAINT	The more problems faced by entrepreneurs in applying for loans from conventional FIs, the

GET LOANS	more receptive they would be of the MFC, which to them is more of an investment activities with the IBs. **None of the previous study had further explained on this variable.*

Mean Rank Analysis

The study also conducted a mean rank analysis. This analysis was undertaken in order to see which Banking Choice Factors (BCFs) are considered the most favourable factors by the respondents based on the five-point likert-typed scale. By looking at their mean ranks, one can relate the result to the significant aspects of the BCFs that contribute to the acceptance of the MFC by SMEs. Basically, there were 22 BCFs that needed to be analysed using a mean rank analysis in which the factors can be ranked based on their means. Since they were in the form of ordinal scale, they were easily grouped and analysed together, and the non-parametric test, which was the Friedman test, was performed in order to test the significance of the BCFs. The Chi-square value is 1288.688 with 21 degrees of freedom and the observed significance level or p is equivalent to 0.000, which is lower than 0.05 confidence level. All this implies that the variations between the 22 variables are likely to hold in the population. Thus, it may be inferred that the ranking of importance among the BCFs is statistically significant. The results in table 3 reveal that small traders highly regard the factors that are related to the reputation and image including the environment, image, and accessibility. This indicates that people normally believe in first impression. The 'halo effect' really plays a big role in influencing attitudes of acceptance. The result is in accordance with the study undertaken by Dusuki and Abdullah (2007) where the customers were really concerned about the performance of the BCFs provided to them. The next factors which received moderate acceptance from the SMEs are related to the services of the staff, which indicates that most people either through their experience or perception believe that the staff of IBs scored moderately in terms of service performance.

Furthermore, BCFs that are related to the MFC received moderate acceptance rate from the small traders. This indicates that even though *Musharakah* is not very well-known to them, they believe that these factors could be accepted particularly due to the nature of the concept that is based on a partnership. Lastly, there were four variables that received the lowest acceptance rate from the small traders. These factors are related to the element of risk, not enough promotion, inadequate initiative to penetrate new markets, and the unfamiliar terms used in labelling the financing products have caused the MFC to be unpopular among the traders. Thus, IBs need to pay more attention to the efforts of educating and promoting the concept as a financing or more appropriate as an investment tool for SMEs to expand their businesses.

No.	Banking Choice Factors	Mean Rank*	Rank
1.	A5_HIGH_TECHNOLOGY	15.33	1
2.	A16_COMFORTABLE_ENVIRONMENT	14.92	2
3.	A19_ACCEPT_IF_UNDERSTAND	14.89	3
4.	A11_REPUTATION_IMAGE	14.70	4
5.	A15_EASILY_ACCESSIBLE	13.35	5
6.	A9_STAFF_TRUSTWORTHY	12.50	6
7.	A7_FRIENDLY_HELPFUL	12.13	7
8.	A13_SOCIAL_RELATIONSHIP	12.07	8
9.	A18_ACCEPT_CONCEPT	12.06	9
10.	A21_PLS_PRINCIPLE	11.98	10
11.	A1_WIDE_RANGE_PRODUCT	11.88	11
12.	A2_MORE_ST_FIN	11.56	12
13.	A14_ENOUGH_BRANCHES	11.19	13
14.	A20_MUSHARAKAH_DESIGN	11.08	14
15.	A6_KNOWLEDGEABLE_TRAINED	10.65	15
16.	A3_COMPETITIVE_CHARGE	10.59	16
17.	A12_FAST_EFFICIENT	10.39	17
18.	A8_COMPETENT_GOOD	10.35	18
19.	A22_NON_RISKY_FIN	9.21	19
20.	A4_ADEQUATE_PROMOTION	8.49	20
21.	A10_SEARCH_NEW_MARKET	7.59	21
22.	A17_FAMILIAR_TERM	6.11	22
Friedman Test			
N		**350**	
Chi-Square		**1288.688**	
Degree of Freedom		**21**	
Asymp. Sig.		**0.000**	

Table 3. Mean Rank Analysis of BCFs

**Mean rank values are derived from the non-parametric test i.e. Friedman test.*

THE INVOLVEMENT OF IBs IN THE MFC

The final research objective is to identify the extent of the involvement of IBs in KKCC in the *Musharakah* contract. From profile analysis done on eight IBs located in KKCC, several contributors, which are considered as moderating factors, might lead to the moderate acceptance of the MFC among SMEs. These factors are: (i) the MFC is relatively new to the market, (ii) inadequate banking staff and no expertise in handling the MFC, (iii) lack of product knowledge pertaining to the MFC among the banking staff at the branch level, (iv) lack of training done within a year with regard to handling the MFC, (v) lack of educational programs related to the MFC provided to the SME sector, (vi) lack of market information, which is due to no or inadequate feasibility studies done on the SME sector, (vii) lack of market search to penetrate new markets and encourage ventures with SMEs, (viii) lack of advertisement done on the MFC, and (ix) lack of market understanding due to the lack of effort from staff of IBs to go out and get acquainted with SMEs. This situation may have caused IBs' refusal to be involved in the MFC, which in turn, contributes to the unpopularity of the MFC among SMEs.

REFERENCES

[1] Al-Harran, S. *Leading Issues in Islamic Banking and Finance*. Kuala Lumpur: Pelanduk Publications (M) Sdn. Bhd. (1995).

[2] Al-Sultan, W. *Financial Characteristics of Interest-Free Banks and Conventional Banks*. An Unpublished PhD Thesis. University of Wollongong (1999).

[3] Babbie, E., Halley, F. and Jeanne, Z. *Adventures in Social Research: Data Analysis Using SPSS 11.0/11.5 for Windows* (5th edition). USA: Sage Publications (2003).

[4] Cowdell, J. and Farrance, C.C. *Marketing of Financial Services*. London: Sheffield Hallam University (1995).

[5] Dusuki, A.W. and Abdullah, N.I. Why Do Malaysian Customers Patronize Islamic Banks? *International Journal of Bank Marketing*. **25**(3): 142-160 (2007).

[6] Haron, S.N., Norafifah, A. and Planisek, S.L. Bank Patronage Factors of Muslim and Non-Muslim Customers. *International Journal of Bank Marketing*. **12**(1): 32-40 (1994).

[7] IBFIM. *Musharakah* Contract and Its *Shariah* Issues. *Islamic Finance Bulletin*. April-June **20**: 1-8. Kuala Lumpur: Islamic Banking and Finance Institute Malaysia Sdn. Bhd. (2008).

[8] Mahmud, Z. *Handbook of Research Methodology: A Simplified Version*. Shah Alam: University Publication Centre (2008).

[9] Metwally, M. Attitudes of Muslims towards Islamic Banks in a Dual-Banking System. *American Journal of Islamic Finance*. **6**(1): 11-17 (1996).

[10] Nik Yusoff, N.M.A. *Islam & Business*. Selangor: Pelanduk Publications (2002).

[11] SMIDEC. *Small and Medium Enterprise (SME) Annual Report 2005*. Kuala Lumpur: BNM (2005).

[12] Zainuddin, Y., Jahyd, N. and Ramayah, T. Perception of Islamic Banking: Does It Differ among Users and Non Users. *Jurnal Manajemen dan Bisnis*. **6**(3): 221-232 (2004).

Safety Climate in Manufacturing Industry: Effect of Demographic Factors between Employee and Supervisor

Nor Azma Rahlin[1,*] **Nik Wan Omar**[1] and **Azizah Endut**[2]

[1] Faculty of Business Administration and Accounting, University Sultan Zainal Abidin Kampus Gong Badak, Kuala Terengganu, Terengganu.

[2] Faculty of Innovative Design and Technology, University Sultan Zainal Abidin, Kampus Gong Badak, Kuala Terengganu, Terengganu.

* Corresponding author, Email: ema_azmarina@yahoo.com

Abstract

This study examined selected demographic factors among employees and supervisors in order to identify safety climate in Malaysia automotive industry. The simple random stratified sampling procedure was used with involvement of 194 respondents. The data collection is gathered from focus group interview and questionnaires methods with employees and supervisors. These data were analyzed with Chi-square test using SPSS program. Analyses of the data revealed that there were the different effects between safety climate variables at age, marital status, education level, and accident experienced. The results as depicted in Table 1 to Table 4 show that all demographic factors unless education levels were significantly affect safety climate among employees and supervisors. It is concluded that since determinant factor of safety climate was influenced by demographic factor, the organization should be aware of the problems in order to develop more effective safety programs according to the referents of employee sub groups.

Keywords

Automotive Industry; Demographic Factor; Safety Climate.

Table 1. Chi-Square test of age between employee and supervisor

	Age				
	0-20	21-25	26-30	31-37	38-43
Management commitment and participation	a	b	0.297	0.406	0.604
Personal protective equipment	a	b	0.015	0.166	0.113
Enforcement of legislation and procedure	a	b	0.038	0.514	0.375
Employee's and supervisor aspect	a	b	0.049	0.772	0.057
Safety environment	a	b	0.326	0.923	0.151
Job stress	a	b	0.326	0.923	0.151

Note: N=194, $p < 0.05$

[a] No statistics are computed because variable and designation are constant

[b] No statistics are computed because designation is constant

Table 1 shows the interaction between age and safety climate variables. When the variables are aligned (employees and supervisor) there is no significant difference between both designations. Out of six determinant factors for safety climate, three variables namely personal protective equipment, enforcement of legislation and procedure, and employee's and supervisor aspect were significantly different with respondents of age range between 26-30 years. The Chi-square consists of 8.413, 8.405, and 6.017 with significant level less than 0.05.

Table 2. Chi-square test of marital status between employee and supervisor

	Marital status	
	Single	Married
Management commitment and participation	0.481	0.411
Personal protective equipment	0.160	0.760
Enforcement of legislation and procedure	0.197	0.002
Employee's and supervisor aspect	0.046	0.375
Safety environment	0.577	0.961
Job Stress	0.457	0.474

Note: N=194, $p < 0.05$

Table-2 shows Chi-square of marital status between employee and supervisor in safety climate. The result of the Chi-square comparison test shows that the significant different only found in enforcement of legislation and procedure and employees and supervisor aspect. In other hand, other variables do not show any significant difference between employee and supervisor.

Table 3. Chi-square test of education level between employee and supervisor

	Degree & equivalent /higher	Diploma & equivalent	STPM & equivalent	SPM & equivalent	PMR & equivalent / Others
Management commitment and participation	0.543	0.674	0.257	0.161	0.361
Personal protective equipment	0.958	0.230	0.165	0.564	0.478
Enforcement of legislation and procedure	0.329	0.055	0.829	0.121	0.368
Employee's and supervisor aspect	0.369	0.065	0.257	0.139	0.425
Safety environment	0.465	0.440	0.308	0.808	0.821
Job Stress	0.256	0.221	0.741	0.079	0.323

Note: N=194, $p < 0.05$

Table-3 shows that Chi-Square of education level among respondents. It is seen that all safety climate variables have values higher than 0.05. It means that all Chi-square values have no significant difference between employee and supervisor.

Table 4. Chi-square test of accident experience between employee and supervisor

	Yes	No
Management commitment and participation	0.511	0.632
Personal protective equipment	0.569	0.927
Enforcement of legislation and procedure	0.979	0.001
Employee's and supervisor aspect	0.460	0.321
Safety environment	0.897	0.593
Job Stress	0.602	0.950

Note: N=194 $p < 0.05$ v

Table-4 illustrates the Chi-square value for the accident experience between employee and supervisor. Statistically, there were no significant differences in all safety climate variables unless in enforcement of legislation and procedure for those who have no accident experience ($p = 0.001$). Therefore the Chi-square statistics represent for enforcement of legislation and procedure significant figure are, λ^2 (2) = 16.855, p=0.001.

ACKNOWLEDGMENTS

The authors would like to express their deepest appreciation to Mr. Amirumizan Rofie for their kind cooperating in data collection of this study.

REFERENCES

[1] J. M. Beus, S. C. Payne, M. E. Bergman and W. Arthur Jr, 2010, Safety Climate and Injuries: An Examination of Theoretical and Empirical Relationships. Journal of Applied Psychology 95, 713-727.

[2] M. A. Griffin and A. Neal, 2000, Perceptions of Safety at Work: A Framework for Linking Safety Climate to Safety Performance, Knowledge, and Motivation. Journal of Occupational Health Psychology 5, 347-358.

[3] G. Luria and D. Yagil, 2010, Safety perception referents of permanent and temporary employees: Safety climate boundaries in the industrial workplace. Accident Analysis & Prevention 42, 1423-1430.

[4] N. Cavazza and A. Serpe, 2009, Effects of safety climate on safety norm violations: exploring the mediating role of attitudinal ambivalence toward personal protective equipment. Journal of Safety Research 40, 277-283.

[5] M. N. Vinodkumar and M. Bhasi, 2009, Safety climate factors and its relationship with accidents and personal attributes in the chemical industry. Safety Science 47, 659-667.

[6] S.-H. Lin, W.-J. Tang, J.-Y. Miao, Z.-M. Wang and P.-X. Wang, 2008, Safety climate measurement at workplace in Chia: A validity and reliability assessment. Safety Science 46, 1037-1046.

[7] O.-l. Siu, D. R. Phillips and T.-w. Leung, 2004, Safety climate and safety performance among construction workers in Hong Kong: The role of psychological strains as mediators. Accident Analysis & Prevention 36, 359-366.

Motivational Synergy: Toward New Conceptualizations of Intrinsic and Extrinsic Motivation in the Workplace

Ahmed Kh. Muttar
Universiti Tenaga Nasional
Jalan Ikram-UNITEN, 43009 Kajang, Selangor, Malaysia

Abstract

The foundation for a model of motivational synergy is presented. Building upon but going beyond previous conceptualizations, the model outlines the ways in which intrinsic motivation (which arises from the intrinsic value of the work for the individual) might interact with extrinsic motivation (which arises from the desire to obtain outcomes that are apart from the work itself. In a modification of the prevailing psychological view that extrinsic motivation undermines intrinsic motivation, this conceptualization proposes that certain types of extrinsic motivation can combine synergistically with intrinsic motivation, particularly when initial levels of intrinsic motivation are high. Such synergistic motivational combinations should lead to high levels of employee satisfaction and performance. Especially this can be use as an effective tool in work trap situation where there is more pressure from extrinsic which reduces the level of intrinsic motivation.

Social Reporting by Islamic Banks: A Comparative Review of Malaysia and Indonesia)

Rifqi Muhammad
International Islamic University, Malaysia

Management Style and Staff Morale in Private Institutions in Malaysia: A case study of International College University of Technology (TWINTECH)

Mpawenimana
International Islamic University, Malaysia
Mpawenimana@yahoo.com

POSTER

SCIENCES AND TECHNOLOGY

Xanthan Gum Recovery from Palm Oil-based Microbial Cultivation Broth by Membrane Filtration: Optimisation of Process Conditions using Taguchi Method

Mohamad Sufian So'aib',*, Murthy VPS Veluri
Faculty of Chemical Engineering, Universiti Teknologi MARA (UiTM), 40000 Shah Alam, Selangor
*sufian_sj@yahoo.com

Abstract
In this paper, we described the recovery of xanthan gum from palm oil-based microbial cultivation broth by employing the membrane filtration as more economical and simple alternative than centrifugation and precipitation. The optimal conditions for high recovery rate and high purity were conveniently carried out using Taguchi method. The factors examined were pH, ionic strength, transmembrane pressure (TMP) and cross flow velocity, each varied at three different values across three different oil fractions; 0, 35 and 55 (%v/v), where cross flow velocity turned out the most significant factor. Statistical analysis by ANOVA displayed the significance of each factor which is useful to determine operational range for scale up process.

Keywords
Xanthan gum, membrane filtration, Taguchi.

INTRODUCTION

Xanthan gum is widely used in food and cosmetics products as emulsion stabilizer and as drilling fluid during oil recovery. Recent study developed palm oil-based fermentation broth which reduces broth's viscosity thus greatly enhanced xanthan gum production by, yet the recovery and purification process is very complicated due to emulsified nature of the raw broth. Unfortunately, no research had come up with viable strategy to produce final purified xanthan from this type of broth. On the other hand, centrifugation is the most common method for biomass removal from conventional xanthan gum fermentation broth, later followed by precipitation and recentrifugation. Nevertheless, this approach is expensive as enormous amount energy and precipitation agent required for centrifugation and precipitation respectively.

Taguchi method had been employed for optimization studies in myriad applications such as engineering, chemistry, microbiology and agriculture while only recently gained interest in membrane related researches. Undoubtedly, this method is the most convenient, economical and the quickest way to carry out optimization process involving multiple parameters, as oppose to conventional trial and error experimental strategy which is costly and time-consuming.

MATERIALS AND METHODS

Membrane

The membrane used was a flat PALL SUPOR polysulfone membrane having pore size 0.2 μm and surface area 0.093 m^2.

Preparation of the feed solution

The feed solution used was xanthan produced from fermentation of Xanthamonas campestris in a bioreactor. The fermentation procedures were described elsewhere. The raw broth was diluted 10 times prior to filtration.

Experimental design

Taguchi method was used as Design of Experiment (DOE) tool. Four most important parameters (factors) were examined; TMP, pH, CFV and ionic strength (IS). Then three different values were assigned for each factor and cell rejection and flux rate were chosen as the performance characteristics. The factors and their respective levels are summarized in Table 1.

Table 1: Factors and their respective levels

Parameters	Level		
	1	2	3
A: TMP (bar)	0.60	1.55	2.00
B: CFV (l/min)	0.75	1.25	2.00
C: IS (M)	0.1	0.2	0.3
D: pH	4	7	9

L_9 (3^4) orthogonal array of Taguchi design which comprised of four factors with three levels each was chosen. The experimental trials are displayed in Table 2.

Table 2: L_9 (3^4) design array by Taguchi method

Trial no.	Factors and their levels			
	A:TMP (bar)	B:CFV (L/min)	C:EIS (M)	D:pH
1	1	3	3	3
2	3	1	3	2
3	2	1	2	3
4	1	2	2	2

5	2	3	1	2
6	3	3	2	1
7	3	2	1	3
8	1	1	1	1
9	2	2	3	1

Taguchi method uses loss function to describe the deviation of the responses from the desired value. This deviation is expressed in terms of signal to noise ratio (S/N ratio). The largest possible S/N ratio value is desirable as it reflects the dominance of factors over noise. This study was aimed to achieve maximum recovery rate hence the S/N ratio larger-the-better was chosen to reflect the most optimum condition. S/N ratio is evaluated by the following equation:

$$SN_L = -10\log\left(\frac{1}{n}\sum_{i=1}^{n}\frac{1}{Y_i^2}\right) \quad (1)$$

Where SN_L is larger-the-better performance characteristic, n is the number of repetition of a particular experimental trial and Y_i is the response value of the *i*th experiment. A confirmation experiment is carried out to validate the optimal conditions identified by S/N ratio values and the methodology in general. Confirmation experiment result will be compared with the predictive result calculated by the following additive model equation in terms of S/N ratio, i.e. Y_{opt}:

$$Y_{opt} = \overline{T} + (\overline{A_i} - \overline{T}) + (\overline{B_j} - \overline{T}) + ... \quad (2)$$

Where $\overline{T}$ is the average S/N ratio values of all performance characteristics, $\overline{A_i}, \overline{B_j}$ etc. are the average optimum S/N ratio values of factors A, B etc. which occurred at level i, j etc. Y_{opt} will be converted to original experimental value using equation 1. It is necessary the confirmation experiment result falls within acceptable range of error i.e. at sufficient degree of confidence interval, CI (≥95%) which is given by the following equation.

$$CI = \pm\left(F_{\alpha:(1,f_e)}V_e\left[\frac{1}{n_{eff}} + \frac{1}{R}\right]\right)^{1/2} \quad (3)$$

Where $F_{\alpha:(1,f_e)}$ is F ratio at 5% significance (α=0.05), f_e is error's DOF, V_e is error's variance, n_{eff} is effective number of replication = N/{1+[Total DOF associated in the estimate of mean]}, R=number of repetition of confirmation experiment and N = total number of experiment.

Analytical method

Analysis of Variance (ANOVA)

Cell rejection percentage is calculated using the following equation:

$$R(\%) = \left(1 - \frac{C_p}{C_f}\right) \times 100 \quad (4)$$

Where R is cell rejection percentage, C_f and C_p is the concentration of cell and xanthan in the feed and permeate respectively. The cell concentration is determined by optical density at 600 nm using UV-vis spectrophotometer and linear calibration curve of known cells concentration. The flux rate is determined by collecting the permeate volume at a time length divided by the membrane surface area. The xanthan concentration was measured by dry weight method.

Characterization and purity analysis were carried out using Fourier transform infra red (FTIR), thermogravimetric analysis (TGA) and gas chromatography (GC).

RESULTS AND DISCUSSION

The results of the responses and their respective SN_L ratio were given in Table 3. It was observed that the complete cell rejection was achieved at any experimental combination, thus implied that membrane filtration was effective technique for biomass removal during the recovery of xanthan gum from fermentation broth. SN_L analysis at every level of factor was carried out to determine the most optimal combination of factor's levels.

Table 3: Values of responses and their respective SN_L values

Trial no.	Response 1	Response 2			
	Cell rejection (%)	Flux 1 (l/m² h)	Flux 2 (l/m² h)	Mean flux (l/m² h)	SN_L
1	100	3.60	3.60	3.600	11.13
2	100	1.94	1.87	1.905	5.60
3	100	2.23	2.02	2.125	6.56
4	100	2.66	2.52	2.590	8.27
5	100	3.96	3.60	3.780	11.56
6	100	4.32	4.14	4.230	12.53
7	100	2.59	2.74	2.665	8.52
8	100	2.02	1.87	1.945	5.78
9	100	2.45	2.45	2.450	7.78

The effects of each level of factors to SN_L values were displayed in Figure 1 where the most optimal level of factor indicated by the highest SN ratio occurred at third level of TMP, third level of CFV, second level of IS and third level of pH as summarized in Table 4.

Table 4: Optimal condition for flux rate

Factor	Level Description	Level
TMP (bar)	2	3
CFV (L/min)	2	3
IS (M)	0.2	2
pH	9	3

Table 5: ANOVA table for average permeate flux, *F value at 95% confidence level: $F_{0.05;2;2}$=19

Parameters	Sum of square (SS)	DOF	Variance	F value	*F_{cr}	p-value	Percent Contribution (P)
TMP	0.077	2	0.038	3.61	19	0.2171	1.32
CFV	5.555	2	2.778	261.82	19	0.0038	95.5
IS	0.164	2	0.082	7.74	19	0.1145	2.82
pH	(0.021)	(2)		(Pooled)			(0.36)
Error	0.021	2	0.011				0.36
Total	5.817	8					100

ANOVA was carried out to investigate the influence of each factor on the response based on its average SN ratio. F value indicates the significance of each factor to the response. Large F value corresponds to greater significance factor on the response. F value greater than 1 indicates that the effect of the controllable factors on the response is more significant than the effect of noise and vice versa. For the latter case, that particular factor will be pooled as error term. In addition, other statistical terms in ANOVA analysis such as p-value and percent contribution to the response (P) are useful to predict the optimum condition. From Table 5 and Figure 2, it was evident that CFV had the greatest effect on the response due to its large percent contribution (95.5%) and also statistically significant as indicated by its F value (261.82) which was greater than F critical value (19). TMP and IS, despite having F value greater than 1, were far less than F critical value thus considered statistically insignificant and have no meaningful effect on the response. The F value of pH was less than 1 thus pooled as error. Also the error contribution to the response was only 0.36%, far less than the maximum allowable error of 50%, thus the overall experimental approach and the results obtained were reliable.

Since none of the experimental trials were carried out based on optimum condition suggested in Table 4, the predicted flux rate has to be calculated using equation 2 based on average SN ratio values at optimum level as presented in Table 6, with the exception of pH, since it already pooled as error term. The calculated SN value of Y_{opt} was 12.47. This corresponds to the mean value of flux in original term equals to 4.2 l/m^2 h. The confidence interval CI was calculated from equation 3 based on the values of the following terms: $f_e = 2, F_{\alpha:(1,f_e)} = F_{0.05:(1,2)} = 18.51$, R=1, N=9, V_e = 0.011, DOF associated with estimation of mean (Y_{opt}) = 3×2=6, n_{eff} = 9/(1+6) = 1.286. Thus the calculated CI = ± 0.4. Therefore the 95% confidence interval of the predicted optimum flux equals to 4.2±0.4 l/m^2 h i.e. in the range between 3.8 to 4.6 l/m^2 h.

Table 5: Average SN_L values at each level of factor

Parameters	Average SN_L		
	Level		
	1	2	3
TMP	8.39	8.63	8.88
CFV	5.98	8.19	11.74
IS	8.62	9.12	8.17

Confirmation experiment

Confirmation experiment is the final step to verify the optimum condition determined by Taguchi design. The experiment was carried out according to the optimal setting presented in Table 4. The result was later compared with the predicted optimum flux at 95% confidence interval determined previously. The value of flux based on optimal setting was 4.08 l/m^2 h which also fell within 95% confidence interval of predicted optimum value, hence validated the Taguchi method. This also proved that non-interactive model used in equation 2 is sufficient to predict mean flux value, thus possible interaction of factors which may affects the response can be neglected. The optimal condition, predicted and observed (from confirmation experiment) values are summarized in Table 7.

Table 6: Optimum working condition, the observed and predicted flux

Parameters	Optimum working condition	
	Value	Level
TMP (bar)	2	3
CFV (L/min)	2	3
IS (M)	0.2	2
Observed flux (from confirmation experiment) (l/m^2 h)	4.08	
Predicted flux (l/m^2 h)	4.2	
Predicted flux at 95% confidence interval (l/m^2 h)	3.8-4.6	

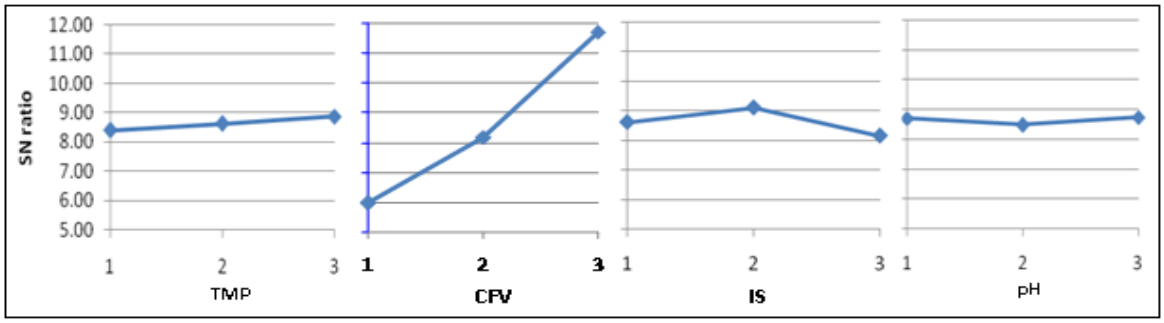


Figure 1: S/N ratio of permeate flux

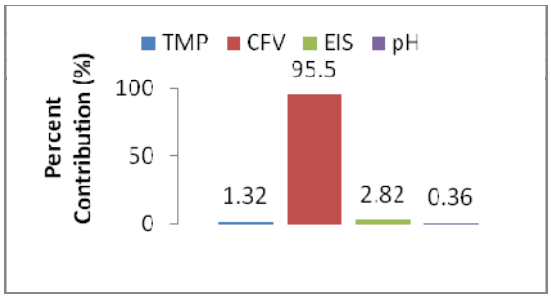


Figure 2: Contribution of factors to the response

CONCLUSION

Taguchi method had been proven as a convenient tool to determine the optimal conditions for xanthan gum recovery by membrane filtration in terms of recovery rate. The optimal conditions identified in this study are also applicable in larger scale so long the confirmation experiment is carried out to validate the predicted result derived from Taguchi method.

ACKNOWLEDGEMENT

The authors wish to gratefully acknowledge the Ministry of Science and Innovation of Malaysia for financial support through EScience Fund

REFERENCES

[1] S. G. Kuttuva, A. S. Restrepo, L.K. Ju Applied Microbial Biotechnology (2004) 64: 340–345
[2] M. J. Lopez et al., Journal of Applied Microbiology 90 (2001) 831
[3] Fabien Letisse et al., Applied Microbiology Biotechnology 55 (2001) 418
[4] M. J. Lopez et al., Water Research 35 (2001) 1829
[5] S. Rosalam, R. England, Enzyme and Microbial Technology 39 (2006) 205
[6] M. Papagianni et al., Process Biochemistry 37 (2001) 74
[7] Z. B. Gonder et al., Separation and Purification Technology 70 (2010) 265-273
[8] M. Hesampour et al., Journal of Membrane Science 325 (2008) 199-208
[9] S. G. Kuttuva et al., Applied Microbial Biotechnology 64 (2004) 342
[10] M.S. Safarzadeh et al.,Separation and Purification Technology 58 (2008) 370
[11] Hari Singh and Pradeep Kumar, *Sadhana* Vol. 31, Part 6 (2006) 680.

Estimation of Bone Age Using Distal Radius Analysis

Sadiah Jantan, Aini Hussain*, Mohd. Marzuki Mustafa
Department of Electrical, Electronic and Systems Engineering
Faculty of Engineering & Built Environment, Universiti Kebangsaan Malaysia, 43600 Bangi, Malaysia
Email: aini@ eng.ukm.my

Abstract
This paper presents a methodology to estimate bone age using mathematical modeling based on the distal radius feature. The procedure includes preprocessing, feature extraction, and bone age estimation. The analysis shows the exponential curve fitting is best to estimate the bone age. The analysis is simple and reliable up to 14 years old for male and 13 years old for female.

Keywords
bone age estimation, distal radius, feature extraction

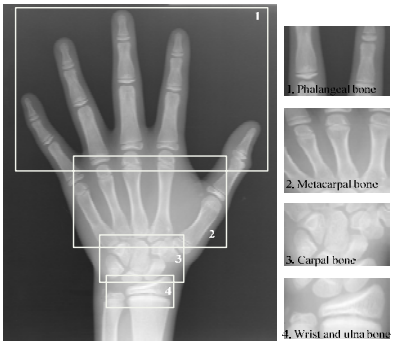
INTRODUCTION

Bone age assessment or skeletal maturity, an essential part of pediatric endocrinology, is usually perform in children and adolescents for clinical diagnosis of endocrinological problems and growth disorders [1, 2].The assessment can be estimated from radiographs of their left hand and wrist. The bones in the radiograph are compared to the bones of a standard atlas.

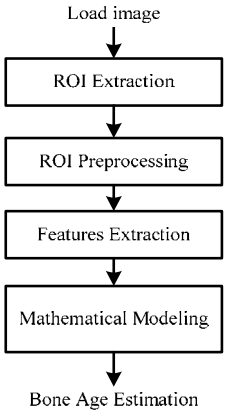
Manual bone age comparison can be divided into holistic and analytic methods [3]. The most commonly used holistic reference standard method is the Greulich and Pyle (GP) atlas [4]. However, a direct comparison of the radiograph of a child's hand to the pages of the GP atlas encourages intuitive or experience-based approach since the results is highly dependent on the raters' variability and maturity mainly depending on the age scale [5]. The analytic methods include the Tanner Whitehouse (TW) [6] that would mainly depend on a set of score. The analysis of the radiograph is time consuming and extremely exhausting for radiologists due to precision requirement during diagnosis.

Previous work in hand and wrist bone age analysis have involved the use of four region of interest (ROI), namely phalangeal [7-13], metacarpal [14, 15], carpal [16-18], and radius and ulna bones [19, 20] as shown in Fig. 1. Radius and ulna wrist bone are two of the most important bone in TW3 analysis [19]. However, research in this area is still very few.

This work presents a simple approach to bone age estimation.The flowchart of this work is illustrated in Fig. 2 in which a mathematical modeling approach is used to estimate the bone age.



A Digital Xray Image of an Asian American male with chronological age of 13.29 years old with 4 region of interest of bone age assessment analysis; 1.Phalangeal bone 2.Metacarpal bone 3.Carpal bone 4.Wrist and ulna bone. [Source of image: www.ipilab.org/BAAweb]



The flowchart of bone age estimation

MATERIALS AND METHODS

Database

The database comprises of 333 left-hand digital Xray images which include 167 boys of Asian American male (ASIM) and 166 girls of Asian American female (ASIF) aged between 00 to 18 years old retrieved from the database of Universiti of Southern California at http://www.ipilab.org/BAAweb. The radius and distal end (RDROI) ROI image from the whole left-hand image was cropped manually from the whole hand Xray images.

Anisotropic Diffusion

Generally, Xray images are poor in contrast and have nonuniform background. Anistropic diffusion filter proposed by Perona and Malik [21] that perform a multi-scale image analysis offers the advantage of reducing the noisy homogeneous areas while at the same time preserving the edges and contrast [21] as shown in the formulation below.

$$\frac{dI}{dt} = div\left[(x, y, t)\nabla I\right] \qquad (1)$$

$$c(\nabla I) = \frac{1}{[1 + (\|\nabla I\| / K)^2]} \qquad (2)$$

where I is the image, ∇ is the gradient operator, and $c(x, y, t)$ is the diffusion conductance function.

Physiological Features Extraction

In this study, distance was chosen as the geometric feature and Eqs. 3-5 defined the mathematical equation. The widest distance between distal end and radius were extracted and the ratio between them were calculated and saved in Microsoft Excel® file according to age and gender [22]. Radius length was chosen as the numerator of the ratio- to avoid any infinite value in the ratio data since epiphyses ossify later in the bone development. The three equations are shown below.

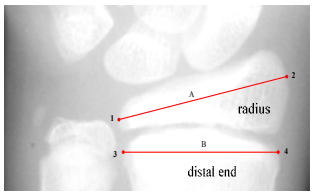
$$A = \sqrt{(X_1 - X_2)^2 - (Y_1 - Y_2)^2} \qquad (3)$$

$$B = \sqrt{(X_3 - X_4)^2 - (Y_3 - Y_4)^2} \qquad (4)$$

$$Ratio = \frac{Dist\ A}{Dist\ B} \qquad (5)$$

where A is the widest distance of Radius, B is the widest distance of Distal End, and R is the ratio of A and B.

Fig. 3 illustrates the manual plotting sequence. The saved data were then analyzed using statistical methods whereby the mean of the ratio and the standard deviation for each age and gender group was calculated.



Manual point plotting to determine the longest distance of the radius and distal end. The number represents the sequence of the point plotting [Source of image: www.ipilab.org/BAAweb]

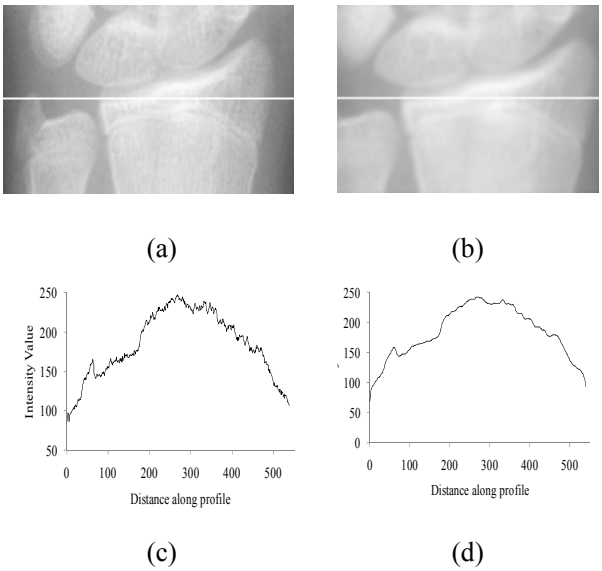
Mathematical Modeling

The ratios data were plotted and curvefitting was done to determine the best possible equation that describes the relationship between the ratios of radius with the bone age estimation.

RESULTS AND DISCUSSION

Anisotropic Diffusion Filtration

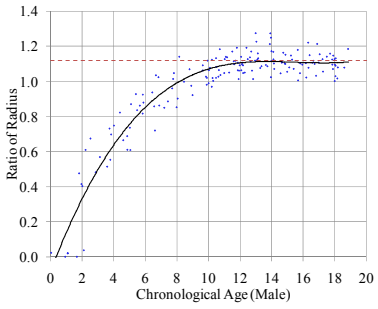
Fig. 4a and 4b show the radius ROI image before filtration and the result after filtration. The intensity value profiles along one horizontal line across the distal radius region for both original and the filtered image were compared and the results as shown in Fig. 4c and 4d reveal that the diffusion process suppressed the noise to some significant extent but at the same time conserve the sharpness of the images.



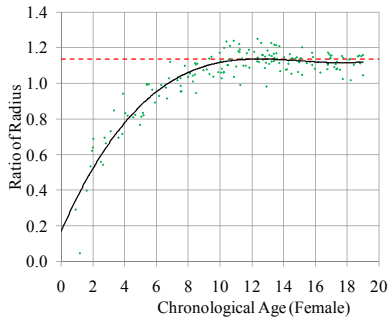
Results of Anisotropic Diffusion filtration (a) Image before filtration (b) Image after filtration (c) Intensity value profile of original image (d) Intensity value profile of the filtered image

The Radius Feature Statistical Correlations

Fig.5a and Fig.5b illustrate the relationship between the ratios of radius versus chronological age. The figure shows the ossification curve exhibits high degree of linearity; therefore, the ratios for both male and female, has a good index to describe the growth condition of the radius bones.



(a)

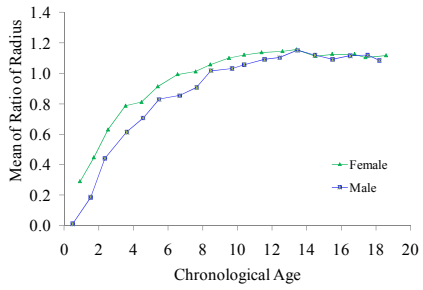


(b)

Ratio of Radius versus Chronological Age for (a) male and (b) female

Growth status of the radius bone between male and female were compared in Fig. 6. The figure indicates the ratio possess high degree of linearity. The radius bone ossifies as early as 0.4 years old and 0.9 years old for male and female, respectively. The value of the ratio is larger in the early age and as the child grows older the ratio becomes smaller and the bone ossifies completely around 14 years old for both male and female.

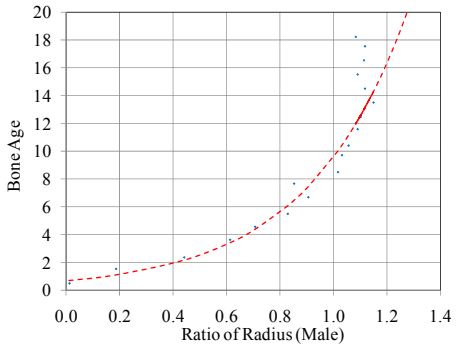
It also can be seen in Fig. 6 that the male growth rate is slower than their female counterpart throughout the maturing process especially in the early years up to the age of thirteen. The growth rate for both male and female somewhat reached a plateau after the age of thirteen in which by this time, the growth rate of the male is similar to that of the female.



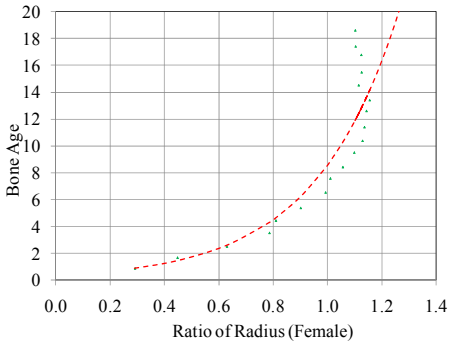
The ratio of radius between male and female were compared

Bone Age Estimation

Based on Fig.7 the bone age as a function of ratio of radius, changes were obstruded up to 14 years old and 13 years old for male and female, respectively.



(a)



(b)

Bone Age estimation with exponential curvefitting for (a) male (b) female

Data were best fitted into an exponential form as in the following equation.

$$y = ae^{bx} \qquad (6)$$

The values for constants *a* and *b*, and the correlations value, for male and female are tabulated in Table 1. The correlation for the exponential curvefit of more than 90% for both male and female indicates that the bone age estimation using the proposed method is reliable.

TABLE 7 THE PARAMETER FOR EXPONENTIAL CURVE

Descriptions	Parameter		Correlation
	a	*b*	R^2
Male, y_m	0.6640	2.6710	0.9699
Female, y_f	0.3349	3.2378	0.9373

CONCLUSIONS

The results of this work clearly show that ratio of radius to distal end has high mutuality to bone age estimation. The observed phenomenon suggested that the ratio can be used to represent the ossification conditions for ages before 14 years old for male and 13 years old for female.

In conclusion, a mathematical model based on physiological feature was proposed to estimate the radius bone growth status. It is apparent that the ratio of radius is an easy and considerable indicator to judge the bone age up to 14 years old.

ACKNOWLEDGMENT

The authors would like to thank Universiti Kebangsaan Malaysia for the funding of this research through research grant contract number UKM-OUP-ICT-36-184/2010. The authors also wish to thank Miss Angeline Teoh Szu Fern [22] for the data used in the study.

REFERENCES

[1] M. I. Boechat and D. C. Lee, "Graphic Representation of Skeletal Maturity Determinations," *American J. of Roentgenology,* vol. 189, pp. 873-874, 2007.

[2] Z. Liu, J. Chen, J. Liu, and L. Yang, "Automatic Bone Age Assessment Based on PSO," *Int. Conf. on Bioinformatics and Biomedical Engineering* pp. 445 - 447, 6-8 July 2007 2007.

[3] H. H. Thodberg, "An automated method for determination of bone age," *J Clin Endocrin Metab,* 2009.

[4] W. W. Greulich and S. I. Pyle, *Radiographic Atlas of Skeletal Development of Hand Wrist*, 2nd ed. Stanford, CA: Stanford University Press, 1971.

[5] M. Yildiz, A. Guvenis, E. Guven, D. Talat, and M. Haktan, "Implementation and Statistical Evaluation of a Web-Based Software for Bone Age Assessment," in *J Med Syst*: Springer Science and Business Media, 2009.

[6] J. M. Tanner and R. H. Whitehouse, *Assessment of Skeletal Maturity and Prediction of Adult Height (TW2 Method)*. London UK: Academic, 1975.

[7] A. Bielecki, M. Korkosz, and B. Zielinski, "Hand radiographs preprocessing, image representation in the finger regions and joint space width measurements for image interpretation," *J. of Pattern Recognition,* vol. 41, pp. 3786-3798, 27 May 2008 2008.

[8] E. Pietka, "Computer-assisted Bone Age Assessment Based on Features Automatically Extracted from a Hand Radiograph," *Computerised Med Imaging and Graphic,* vol. 19, pp. 251-259, 1995.

[9] C.-W. Hsieh, T.-L. Jong, and C.-M. Tiu, "Bone age estimation based on phalanx information with fuzzy constrain of carpals," *Med Bio Eng Comput* vol. 45, pp. 283-295, 2007.

[10] D. Giordano, R. Leonardi, F. Maiorana, G. Scarciofalo, and C. Spampinato, "Epiphysis and metaphysis Extraction and Classification by Adaptive Thresholding and DoG Filtering for Automated Skeletal Bone Age Analysis," in *Int. Conf. of IEEE*, Lyon, France, 2007.

[11] C.-H. Chang, C.-W. Hsieh, T.-L. Jong, and C.-M. Tiu, "A Fully Automatic Computerized Bone Age Assessment Procedure Based on Phalange Ossification Analysis," in *16th IPPR Conference on Computer Vision, Graphics and Image Processing (CVGIP 2003)*, Kinmen, ROC, 2003.

[12] H.-J. Kim and W.-Y. Kim, "Computerized Bone Age Assessment using DCT and LDA," *Springer-Verlag, LNCS 4418,* p. 9, 2007.

[13] B. Zielinski, "Hand Radiograph Analysis and Joint Space Location Improvement for Image Interpretation," *Schedae Informaticae,* vol. 17/18, pp. 45-61, 2009.

[14] A. J. Raheja, "Automated Analysis of Metacarpal Cortical Thickness in Serial Hand Radiographs," in *Department of Biomedical, Industrial and Human Factors Engineering*. vol. Master of Science: Wright State University, 2008, p. 97.

[15] H. H. Thodberg, "Hands-on Experience with Active Appearance models," in *Image Proc. SPIE*, 2002, pp. 495-506.

[16] A. Zhang, A. Gertych, and B. J. Liu, "Automatic bone age assessment for young children from newborn to 7-year old using carpal bones," *Comput Med Imaging Graph,* vol. 31, pp. 299-310, 2007.

[17] C.-W. Hsieh, T.-L. Jong, Y.-H. Chou, and C.-M. Tiu, "Computerized geometric features of carpal bone for bone age estimation," *Chinese Med J,* vol. 120, pp. 767-770, 2007.

[18] P. Lin, F. Zhang, Y. Yang, and C. Zheng, "Carpal-Bone Feature Extraction Analysis in Skeletal Age Assessment Based on Deformable Model," *JCT & T,* vol. 4, pp. 152-156, 2004.

[19] A. Tristan-Vega and J. I. Arribas, "A Radius and Ulna TW3 Bone Age Assessment System," *IEEE Trans. on Med. Imaging,* vol. 55, pp. 1463-1476, 2008.

[20] U. Baumann, R. Schulz, W. Reisinger, A. Heinecke, A. Schmeling, and S. Schmidt, "Reference study on the time frame for ossification of the distal radius and ulnar epiphyses on the hand radiograph," *Forensic Sci Int.,* vol. 191, pp. 15-18, 2009.

[21] P. Perona and J. Malik, "Scale-Space and Edge Detection Using Anisotropic Diffusion," *IEEE Trans. on Pattern Analysis and Machine Intelligence,* vol. 12, pp. 629-639, 1990.

[22] A. T. S. Fern, "Penaksiran Umur Tulang," in *Dept of Electrical, Electronics, and System Engineering*. vol. Bach. of Engineering (Honest) Selangor: Universiti Kebangsaan Malaysia, 2009, p. 121.

Effect of Adsorbent Addition to Lipase Catalyzed Transesterification in Packed Bed Reactor

Harumi Veny*, Mohammed Kheiriddine Aroua, Nik Meriam Nik Sulaiman
Department of Chemical Engineering, Faculty of Engineering, University of Malaya,
50603 Kuala Lumpur, Malaysia.
*my_harumi@yahoo.com

Abstract
The major problem with lipase catalyzed transesterification in Packed Bed Reactor (PBR) is inhibition by adsorption of glycerol onto immobilized support of the enzyme. Hence, two different adsorbent, namely; silica gel and activated carbon were added to the system for glycerol removal. Initially, the amount of silica gel and activated added were 5%. The addition of activated carbon attained much higher methyl ester yield compare to silica gel. Increasing the amount of activated carbon to 10% could obtain methyl ester yield of 74%. However, stability studies by directly reuse of the lipase showed that methyl ester yield was diminished by the increased number of batches in Packed Bed Reactor.

Keywords
Lipase Catalyzed Transesterification, Glycerol Removal, Jatropha oil, Packed Bed Reactor, Adsorbent

INTRODUCTION

Biodiesel production through lipase catalyzed transesterification of vegetable oil have several drawbacks, for instances, methanol inhibition towards lipase activity and glycerol inhibition due to adsorption of glycerol onto immobilized support of lipase. The later mostly occur in Packed Bed Reactor and continuous system. The adsorption will create hydrophilic layer resulted in a limitation of hydrophobic substrate diffusion from medium to enzyme or in a modification of the optimal thermodynamic water activity of the catalyst[1]. Packed Bed Reactor is more preferable system because it can ensure the recycle without catalyst removal. In order to minimize the glycerol inhibition effect, activated carbon and silica gel act as glycerol absorber were added to the system. Activated carbons have long been used as adsorbents in industry due to their superior adsorption capacities [2]. Whereas silica gel is known as good adsorbent for glycerol [3-4]. In this paper, we describe effect of adsorbent addition into PBR system during lipase catalyzed transesterification of jatropha oil. Jatropha curcas oil as used as feedstock in our research is one of the non-edible oils that have a great potential application. It can be grown in very poor soils and produces seeds with high oil content. Therefore it is a more economic source for biodiesel production and lack of competition from the food applications of oils.

MATERIAL & METHODS

Lipase catalyzed transesterification of Jatrophaoil were carried out in Packed Bed Reactor. The Jatropha oil was obtained from Indonesia. The immobilized lipase was from *Mucor Miehei* which was supplied from Sigma Aldrich. Methanol was used as acyl acceptors and added three stepwise. The flow rate in packed bed reactor was set to 5 ml/min. After each run, the product was taken and heated to 95^{o} C for 5 minutes. It is followed by centrifugation at 4,200 rpm for 10 minutes. The clear supernatant was separated and added with hexane for GC analysis. The composition of the esters was analyzed by gas chromatography using an HP 6890 series gas chromatograph system equipped with a flame ionization detector and automated split injector (Agilent 7683 automatic sampler). The column was a 60 m×0.248 mm×0.15 μm DB-23 capillary column (J & W Scientific, USA).

RESULT & DISCUSSION

Selection of adsorbent

Initially, adsorbent was selected based on the yield of methyl ester at the end of transesterification. Activated carbon from palm shell and silica gel were added at 5% (w/w) each. The result is given in Table 1.

Table 1. Adsorbent Selection

Adsorbent	Amount (w/w)	Methyl Ester Yield (%)
silica gel	5%	48%
activated carbon	5%	74.40%
	10%	56%

Activated carbon could act as a better adsorbent compare to silica gel for this process. Hence, further experiment was carried out by doubling the amount of activated carbon (10%). However, increasing the activated carbon amount was lead to reduce of methyl ester yield to 54%. This most probably due to the ability of activated carbon to adsorbed other organic solvent such as methanol.

Stability study with activated carbon as adsorbent

In order to make immobilized lipase become more economical catalyst, it is important to observe its stability. The stability of immobilized *Mucor miehei*

during the process was examined by conducting 4 batch cycles of lipase catalyzed transesterification in Packed Bed Reactor. The amount of activated carbon added was set to 5% for each cycle.

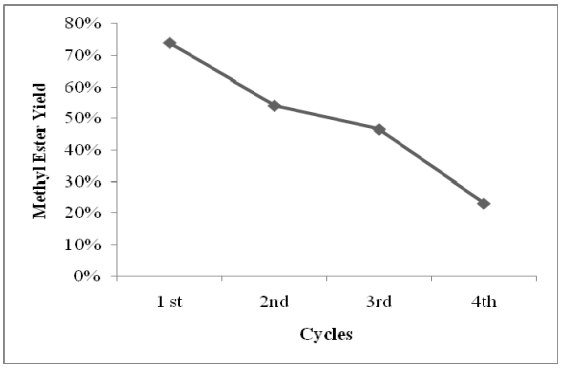


Figure 1. Stability of Lipase in Packed Bed Reactor

The methyl ester yield was decreased with the increasing number of batch cycles (See Figure 1). The methyl ester yields at the first batch cycle were 74% then it decreased to 54%, 46% and 23% at 2nd, 3rd, and 4th cycles, respectively. Hence, the addition of activated carbon could not minimize deactivation of immobilized *Mucor miehei* lipase during repeated used in this process.

CONCLUSION

Adsorbent is expected could help diminish glycerol inhibition effect during lipase catalyzed transesterification of jatropha oil in Packed Bed Reactor. Addition of activated carbon in Packed Bed Reactor would obtained higher methyl ester yield compared to silica gel. The methyl ester yield of 74% could be achieved with activated carbon amount of 5% (w/w). However, stability studies at similar condition in four batch cycles showed that addition of adsorbent could not retain the immobilized lipase activity during lipase catalyzed transesterification in Packed Bed Reactor.

ACKNOWLEDGMENTS

This research was funded by IPPP university of Malaya fund under project no. PS400/2010A and RG012/09AET.

REFERENCES

[1] V. r. Dossat, *et al.*, "Continuous enzymatic transesterification of high oleic sunflower oil in a packed bed reactor: influence of the glycerol production," *Enzyme and Microbial Technology,* vol. 25, pp. 194-200, 1999.

[2] A. Bembnowska, *et al.*, "Adsorption from aqueous solutions of chlorinated organic compounds onto activated carbons," *Journal of Colloid and Interface Science,* vol. 265, pp. 276-282, 2003.

[3] D. E. Stevenson, *et al.*, "Near-quantitative production of fatty acid alkyl esters by lipase-catalyzed alcoholysis of fats and oils with adsorption of glycerol by silica gel," *Enzyme and Microbial Technology,* vol. 16, pp. 478-484, 1994.

[4] A. Safavi, *et al.*, "Glycerol–silica gel: A new solid sorbent for preconcentration and determination of traces of cobalt(II) ion," *Analytica Chimica Acta,* vol. 569, pp. 139-144, 2006.

Coconut Waste Biodiesel: Comparison of Acid and Alkaline Catalyst

Sarina Sulaiman[*1,2], Abdul Aziz Abdul Raman[1] and Mohammed Kheireddine Aroua[1]
[1] Department of Chemical Engineering, Faculty of Engineering,
University of Malaya, Kuala Lumpur
[2] Department of Chemical Engineering, Faculty of Engineering,
International Islamic University of Malaysia, Kuala Lumpur
* rin2207@yahoo.com

Abstract
Biodiesel industry requires a cheaper and economical viable raw material that can replace the vegetable oil. Waste from animal and plant sources became the main option due the availability and cheap. In this study, coconut waste is used to produce biodiesel using methanol, acid sulfuric and KOH. In situ process is used, where all the catalyst, reagent and raw material is mixed together in one system. The highest yield, 90% is achieved with 5 wt% of KOH within 3 hr by mixing raw material and methanol. Acid sulfuric catalyzed process took a longer reaction time and higher amount of catalyst is needed.

Keywords
Biodiesel; waste; in situ process; yield

INTRODUCTION

Worldwide energy crisis due to depletion of resources and increased environmental crisis has led to the exploration for an alternative fuel, which should be not only sustainable but also environment friendly. For developing countries, fuels of bio-origin, such as alcohol, vegetable oils, biomass, biogas, synthetic fuels are becoming vital. Biodiesel derived from oil crops is a potential renewable alternative to petroleum fuels. Biodiesel is produced mainly from soybean oil, sun flower oil [1, 2], animal fat [3], palm oil [4, 5], waste cooking oil [6, 7] and Jatropha oil [8, 9]. Even, okra [10], Morienga [1], jojoba oil, castor oil and sesame oil [11] are used to produce biodiesel.

Nevertheless, biodiesel from oil crops cannot practically satisfy the existing demand for transport fuels and the price of vegetable oil is climbing as well. The high cost in production of biodiesel has become the major obstacle and the use of vegetable oil as raw material is competing with other edible oils. Attaining cheaper raw materials are one of the continuous goals of many biodiesel producing facilities since 70 to 95% of the production costs are attributed to raw materials [12]. One of the main options is to use waste material from animal and plant sources. Few types of wastes used as raw materials in biodiesel production includes, waste bleaching earth, fryer grease oil, waste cooking oil, discarded marine parts, spent coffee ground and sludge. Waste lard and waste cooking oil contains the highest oil and are abundant and cheap.

The mostly available and accepted raw material in Malaysia for biodiesel production is palm oil. Other wastes, either waste oil or animal fats is not fully utilized if compared to other countries. The reason is because low availability of waste and the waste collection is not fully exploited and scattered. The price of palm oil is cheaper if compared to other raw materials and this become the main reason of lack of development of other raw material. Malaysia needs more development in the production of biodiesel by not only depending on the palm oil as the main raw material but to other raw material especially wastes in order to compete with other countries. There are abundant of waste cooking oil, fats and other vegetable wastes that can be fully utilized as cheap feedstock. Lam MK, et al., 2010 reported that 0.5 tonne million/year of waste cooking oil is produced in Malaysia.

In these studies, the waste from coconut industry is used as the feedstock. In Malaysia estimated 3960 metric tons of coconut waste is being generated of which majority are from coconut oil waste and being used as fertilizer or to feed the cows or left to decompose on the fields. Typically coconut may still contain 10-15% extractable oil content and the FAME compositions are C_8 to C_{12}. This forms the justification of this work where methyl ester will be produced by directly subjecting the coconut waste with methanol and catalyst, KOH and acid sulfuric, H_2SO_4. This study is conducted to determine the optimum catalyst loading to produce the highest yield of biodiesel using in situ production.

MATERIAL AND METHODOLOGY

Drying

Coconut waste is dried overnight at 50^{o}C. After drying, the coconut is kept in dry cabinet for further usage.

Insitu Production

In situ production reactions are performed in 150ml jacketed batch reactor. The temperature is controlled by the water bath. The reaction is conducted at 50^{o}C.

Coconut residue is mixed with methanol and KOH in the vessel for 5 hr. Finally, the oil and glycerin is separated using funnel. The oil is washed with warm water (45-50°C).

Analysis

The biodiesel composition is analyzed using GC 6810. The 0.1 mL of sample is diluted with 3.9mL of n-hexane and 1 υL of sample is injected into DB 23 column. The standard mixture of fatty acid is bought from Sigma.

RESULTS AND DISCUSSION

Effect of Acid catalyst on biodiesel yield

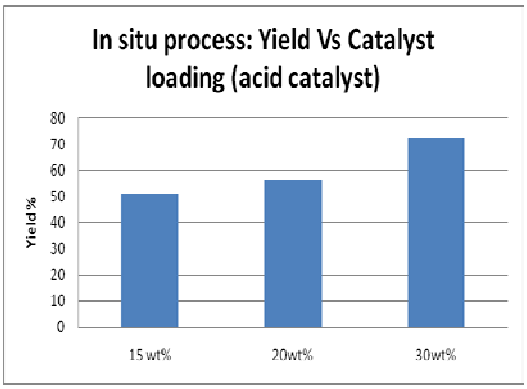


Figure 1. Effect of acid catalyst on the yield

In this process, the reagent, methanol, coconut waste, and the catalyst is mixed together to produce biodiesel. This process are conducted at 60°C, mixing intensity at 700 rpm and reaction time is fixed at 24 hr. Figure 1 shows the effect of acid catalyst on the biodesel yield. The yield increases with the increase of the catalyst loading and longer reaction time.

This proves that acid catalyzed transesterification is a time consuming process with a slower reaction rate [14]. J.M. Dias et al. 2009 also found that it takes 24 hr for the reaction time and higher amount of acid sulphuric is required to achieve a higher yield if compared to alkaline catalyst [15].

Effect of Alkaline catalyst on the biodiesel yield

The in situ production of biodiesel is conducted by mixing coconut residue, 150 ml methanol, and 4 wt % of catalyst and without adding any co solvent. Figure 2 shows the effect of catalyst and time on biodiesel yield. From the figure, the graph pattern shows that after 3 hours of reaction, the yield does not change and stables. K-H. Chung et al., 2009 also reported the same finding that the optimum reaction occurs in 3 hour.

CONCLUSION

Coconut waste is a promising raw material that is cheap and abundant. The highest yield, 78 % is achieved at 3hr with 4 wt% of catalyst. Lesser amount of alkaline catalyst is required if compared to the acid catalyst. The reaction period is shortening by 21 hrs in the case of alkaline catalyzed process with a higher yield. The finding also shows that in situ production eliminates the need to extract the oil and helps in cost reduction in production of biodiesel. In future, heterogeneous or acid catalyst can be used in order to achieve a higher yield.

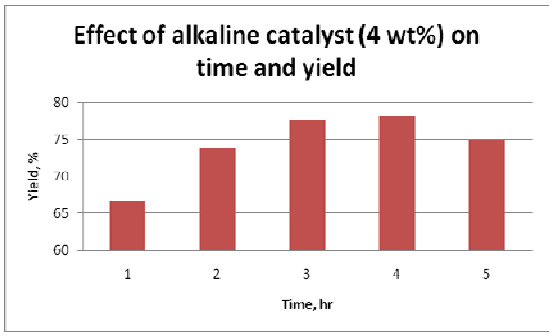


Figure 2. Effect of catalyst and time on biodiesel yield

ACKNOWLEDGMENT

This research is funded by PPP grant (PS401/2010A) from IPPP, University of Malaya, Malaysia.

REFERENCES

[1] U. Rashid, Anwar F, Moser BR, Ashraf S. Production of Sunflower Oil Methyl Esters By Optimized Alkali-Catalyzed Methanolysis. Biomass and Bioenergy (2008), Doi:10.1016/J.Biombioe.2008.03.001.

[2] Sarin R, Malhotra RK, Et Al., Jatropha–Palm: Biodiesel Blends: An Optimum Mix for Asia, Fuel 86 (2007) 1365–1371.

[3] H.N. Bhatti, M A Hanif , M Qasim, A-u. Rehman. Biodiesel Production from Waste Tallow, Fuel 87 (2008), 2961–2966.

[4] O.J. Alamu, M.A. Waheed, S.O. Jekayinfa. Effect Of Ethanol–Palm Kernel Oil Ratio On Alkali-Catalyzed Biodiesel Yield, Fuel 87 (2008) 1529–1533.

[5] M. Aresta, Angela Dibenedetto, Maria Carone, Teresa Colonna, Carlo Fragale. Production of Biodiesel from Macroalgae by Supercritical CO2 Extraction and Thermochemical Liquefaction, Environ Chem Lett 3 (2005) 136–139.

[6] J.M. Encinar , J.F. González, A. Rodríguez-Reinares. Ethanolysis of Used Frying Oil. Biodiesel Preparation And Characterization, Fuel Processing Technology 88 (2007) 513–522.

[7] M. M. Soumanou and Uwe T. Bornscheuer. Improvement in Lipase-Catalyzed Synthesis of Fatty Acid Methyl Esters from Sunflower Oil, Enzyme and Microbial Technology 33 (2003) 97–103.

[8] S.Shah and M. N. Gupta. Lipase Catalyzed Preparation of Biodiesel from Jatropha Oil in A

Solvent Free System, Process Biochemistry 42 (2007) 409–414.
[9] A.V. Tomasevic and S.S. Siler-Marinkovic. Methanolysis Of Used Frying Oil, Fuel Processing Technology 81 (2003) 1 – 6.
[10] F. Anwar, U. Rashid, M. Ashraf and M. Nadeem. Okra (Hibiscus esculentus) seed oil for biodiesel production, Applied Energy, 87, Issue 3 (2010) 779-785.
[11] Karmakar, A., et al. Properties of various plants and animals feedstocks for biodiesel production. Bioresour. Technol. (2010), doi:10.1016/j.biortech.2010.04.079.
[12] Y. Zhang, M.A. Dub, D.D. McLean, M. Kates. Biodiesel production from waste cooking oil: 2. Economic assessment and sensitivity analysis, Bioresource Technology 90 (2003) 229–240.
[13] Lam M. K, Lee K. T. Lee, A.R.Mohamed. Homogeneous, heterogeneous and enzymatic catalysis for transesterification of high free fatty acid oil (waste cooking oil) to biodiesel: A review, Biotechnol Adv (2010), doi:10.1016/j.biotechadv.2010.03.002.
[14] J.Zhang and L. Jiang. Acid-catalyzed esterification of Zanthoxylum bungeanum seed oil with high free fatty acids for biodiesel production, Bioresource Technology 99 (2008) 8995–8998.
[15] J.M. Dias, M. C. M. Alvim-Ferraz, M. F. Almeida. Production of biodiesel from acid waste lard, Bioresource Technology 100 (2009) 6355–6361.

Green Roofs' Potential for Sustainable Development in Malaysia

Lee Xia Sheng[1,*]
[1]Faculty of Built Environment, University of Malaya
*leexiasheng@gmail.com

Abstract
Green roof or vegetated roof is a multifunctional tool for sustainable development. It gives various benefits such as reducing flood risk, mitigating urban heat island effect and building energy saving. Research that explores the potential of green roofs based on Malaysia's climate and conditions should be conducted to address local environmental issues.

Keywords
Green Roof, Vegetated Roof, Sustainable Design, Rainwater Runoff, Urban Heat Island, Building Energy Saving

INTRODUCTION

Global environmental crisis are drawing attention and Malaysia is coping with its very own environmental issues with various approaches including sustainable development. Accepted and adopted by other countries, sustainable development is an approach to economic planning that attempts to foster economic growth while preserving the quality of the environment for future generations [1]. However, sustainable development is not complete without improving the current built environment. While the built environment houses and protects inhabitants from the elements, it is also a major consumer of natural resources (water, energy, materials) and a significant source of environmental pollution (water, air, terrestrial) [2]. Sustainability issues that are related to building environmental issues comprise of diminishing green areas, building energy consumption, urban heat island, flood and polluted rainwater runoff.

As the urbanization process seems inevitable, one promising option for dense urban settings is the greening of buildings [3]. The installations of green roofs or roof gardens, though not a new concept, increase the percentage of greenery in urban built-up area and bring back the vanishing urban green space [4]. Green roof is defined as the creation of 'contained' green space on top of a human –made structure. This green space could be below, at or above grade, but in all cases the plants are not planted on the 'ground' [5]. A large amount of research has been published in German on green roof and based on the depth of the substrate layer and two main types of green roof: extensive and intensive; are usually distinguished in Europe [6] [7]. Extensive green roofs with a substrate layer with a maximum depth of about 150 mm. *Sedum* species usually made up of the major part of the vegetation. Intensive green roofs with a substrate layer with a depth of more than 150 mm. Grasses, perennial herbs and shrubs make up the main constituents of the vegetation.

RAINWATER RUNOFF

One of the major environmental problems of urbanization is that the urban hydrological system has to cope with a highly fluctuating amount of surface runoff water which may become extremely high during periods of rainfall and remains low during the rest of the time [8]. The flood risk in Malaysia is increasing because flood characteristics are changing due to rapid urbanization of catchments. One of the main reasons why highly urbanized areas such as Georgetown and many parts of the places in Kuala Lumpur are so frequently inundated is because of over-development of river valleys [9]. Impermeable surface such as hard roof and pavement are replacing green areas, accelerating the rainwater peak runoff that increase the flood risk in the event of heavy monsoonal and convectional rainfall. A green roof changes rainwater runoff compared with that from a hard roof through lowering (attenuation) and delaying the peak runoff (there is a time lag between the peak from a hard roof and a green roof for the same rain event), as part of the water is detained in green roof . [10].

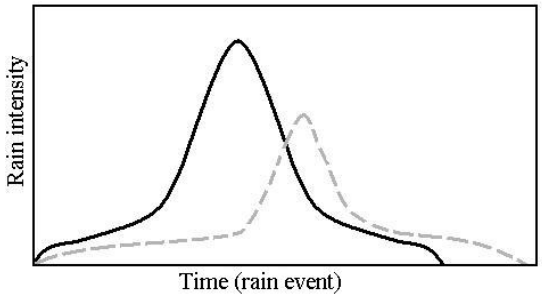


Figure 1. Example comparing runoff from a green roof (dashed line) with runoff from a hard roof (black line) generated by a given rain event.

Thus, replacing hard roof with green roof will significantly lower and delay the peak runoff directly reduces the stress on drainage runoff discharge

capacity. This is an option to reduce flood risk in Malaysia areas without sufficient space

for the drainage improvement or the improvements are too costly.

Polluted Rainwater Runoff

Research show that the retention of heavy metals (lead (Pb), zinc (Zn), copper (Cu), and cadmium (Cd)) in green roof models and found it depend mainly on the runoff reduction capability by green roofs. In the summer months the semi-intensive systems with grass retained 99% of the load of Pb, Zn, and Cu and 98% of Cd. The extensive systems with grass retained 97% Cu, 96% Zn, 92% Cd and 99% Pb. In winter months the semi-intensive roof with vegetation retained 68% Cu, 92% Zn, 88% Cd 94% Pb, and the extensive roof with vegetation retained 44% Cu, 72% Zn, 62% Cd and 91% Pb [11]. Green roofs influence runoff quality through making the pH higher from values between 5 and 6 (in rain water) to over between 7 and 8 (in green roof runoff water) [12] [13]. This is an important function which contributes to lowering the degree of acidification of natural water recipients. The green roofs are mitigating mild acid rain [10]. One benchmark green roof project to mitigate industrial pollution is Ford's Factory, Dearborn, with 10 acres of greenery planted on top of roof [14]. Therefore, the potential of green roof to mitigate pollution due to industrial activities is huge in industrial areas located near cities or towns such as Shah Alam, Cheras, Petaling Jaya, Sungai Buloh and Setapak.

URBAN HEAT ISLAND

Urban heat island (UHI) effect is the phenomena whereby the city centre area exhibits higher temperature as compared to rural or suburban areas. The causes of UHI are increase in anthropogenic heat emissions from combustion of fuel, vehicle emissions and air conditioning, the decrease in green spaces and water; and increase in manmade structures and pavements [15]. Cities in Malaysia are facing UHI effect as more and more green spaces are taken up for development. The process of rapid urbanization means that the number and size of 'hot spot' areas will keep increasing. Malaysia can consider using green roofs as a partial replacement for the lost green space since research show that vegetation surface shows lower radiative temperatures than other hard surfaces with the same albedo [16]. Moreover, measurement on a planted roof in Japan indicated that green roofs can bring thermal benefit to the building as surface temperature decrease of around 30-60.C was observed on site [17]. Given the hot and humid condition in Malaysia, green roofs can provide consistant passive thermal protection for buildings and environment. If green roofs are being implemented on a sufficient scale, they have the potential to help mitigating the uprising global warming effects.

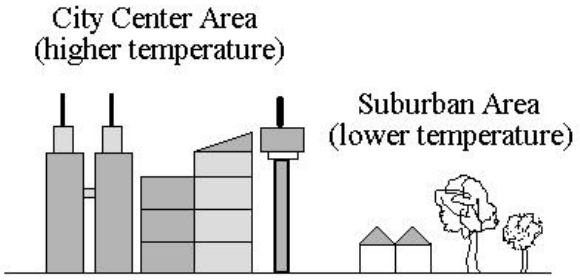


Figure 2. Difference of temperature due to Urban Heat Island Effect.

BUILDING ENERGY SAVING

Generally, the roof plane is the part of a building that receive the most solar radiation and for the longest duration through the day. More than half of solar gain by low height building like a typical terraced house is through its roof. Green roofs can significantly reduce energy use in buildings with poor insulation values, both in summer cooling and winter heating. However, modern buildings, built to the 2006 UK building regulations will have much higher U-Values associated with better roof insulation so green roofs will save no, if very little, energy [18]. These findings encourage retrofitting old buildings without good insulation in Malaysia with green roofs. New construction should also consider green roof as a green building design approach at the same time saving the cost for conventional roof insulation.

GREEN ROOF DEVELOPMENT IN MALAYSIA

Malaysia already has some unique green roof projects such as the 30000sq ft rooftop garden nicknamed *The Secret Garden* on top of 1 Utama shopping complex, Petaling Jaya. The garden also combined green roof technologies with other building-integrated technologies such as chilled water irrigation sourced from the air conditioning system to grow temperate plants and a rainwater harvesting system to recycle rainwater for general irrigation [19]. Such beautiful roof garden will expose the functions and beauty of green roof to the public. On one hand, public and industry stake holders get to learn more about green roof through conferences [20]. On the other hand, local academic institutions have conducted green roof research on foreign countries like Pakistan [21] and Iran [22]. The green roof development is having a good start however the implementation of green roof technologies in Malaysia will depend heavily on adaptation and modification base on local factors such as weather, temperature, native plants selection, human's needs and consumers' preferences.

CONCLUSIONS

Green roofs are very outstanding multifunctional tools for sustainable development in Malaysia and worth the effort to research on their capabilities to tackle

environmental issues in Malaysia. Moreover, green roofs can be also used to promote environmental friendly awareness among public as people can easily relate to current environmental issues when they see a green roof. Thus, To a certain extend, green roofs do contribute to Malaysia's government policy to promote green and sustainable lifestyle.

ACKNOWLEDGMENTS

The work presented in this paper is part of the on-going post-graduate research conduct at Faculty of Built Environment, University of Malaya. The supports from UM academicians and researchers are appreciated.

REFERENCES

[1] Environmental Law.. In Encyclopedia Britannica. (2010) Retrieved August 24, 2010, from Encyclopedia Britannica Online: http://www.search.eb.com/eb/article-224618

[2] Muga, H.E., "An Integrated Framework For Assessing The Sustainability of Components that Make Up The Built Environment", PhD Thesis, Michigan Technological University, U.S.A (2009).

[3] Johnston, J., Newton, J., Building Green: A guide on using plants on roofs, Walls and Pavements, London Ecology Unit. (1995)

[4] Wong, N.H. et al, The Effects of Rooftop Garden on Energy Consumption of a Commercial Building in Singapore. Energy and Buildings 35,pp.353-364 (2003)

[5] Peck, S.W. , Callaghan, C., Kuhn, M.E. , Bass, B. "Greenbacks From Green Roofs: Forging A New Industry In Canada", Status Report On Benefits, Barriers And Opportunities. (1999)

[6] Krupka, B., Dachbegr¨unung. Pflanzen- und Vegetationsanwendung an Bauwerken. Ulmer, Stuttgart. (1992)

[7] Kolb,W., Schwarz, T., 1999. Dachbegr¨unung, intensiv und extensiv.Ulmer, Stuttgart. (1999)

[8] White, R., Building the Ecological City. Woodhead Publication, Cambridge. (2002)

[9] Ngai, W.C., "Increasing flood risk in Malaysia: causes and solutions", Disaster Prevention and Management, Volume 6 Number 2, pp. 72-86 (1997)

[10] Berndtsson, J.C., "Green roof performance towards management of runoff water quantity and quality: A review", Ecological Engineering 36 pp. 351–360 (2010)

[11] Steusloff, S., "Input and output of airborne aggressive substances on green roofs in Karlsruhe." In: Breuste, J., Feldmann, H., Uhlmann, O. (Eds.), Urban Ecology. Springer-Verlag, Berlin, Heidelberg, Germany. (1998)

[12] Bliss, D.J., Neufeld, R.D., Ries, R.J., "Storm water runoff mitigation using a green roof." Environ. Eng. Sci. 26 (2), 407–417. (2009)

[13] Berndtsson, J.C., Bengtsson, L., Jinno, K., "Runoff water quality from intensive and extensive vegetated roofs." Ecol. Eng. 30, 271–277. (2009)

[14] Muller, J., "Lean Green Machine", Forbes. New York. Vol. 171, Iss. 3; pg. 044. (2003)

[15] Wong, N.H., "Combating Urban Heat Island with Green and Sustainable Design", Department of Building, National University of Singapore. (2002)

[16] Wilmers, F., "Effects of vegetation on urban climate And buildings." Energy and Buildings 15–16:507–14. (1988)

[17] Onmura S. Study on evaporative cooling effect of roof lawn gardens. Energy and Buildings 33:653–66. (2001)

[18] Cartleton, H.f., Stovin, V., Beck, S.B.M., Davison J.B., "Green Roof; building energy savings and the potential for retrofit.", Energy and Buildings 42 1582–1591 (2010)

[19] Hiew, I., "Secret Garden at 1 Utama Unveiled.", In Sun2surf. (2009) Retrieved September 29, 2010, from Sun2surf Online:http://www.sun2surf.com/article.cfm?id=32983

[20] Karim, Z., "Modular Green Roof Systems", Green Solutions for Property Development Conference. (2010). Retrieved September 29, 2010, from Online: http://homefinder.com.my/green/greensolutionsflyer.pdf

[21] Abdul Hakim, M., "Affordable Green Roof System for Middle Income Households", Malaysian Journal of Real Estate, 1 (2). Pp. 17-27 ISSN 1823-8505 (2006)

[22] Taheri, M.Z., Rahman, N.A., Salleh, E., "The Perception of Cooling Roofs among Professionals in Iran", ALAM CIPTA, International Journal On Sustainable Tropical Design Research and Practice, 2 (1). Pp.27-32. ISSN 1823-7231 (2007).

Development of a Web-Based System to Facilitate Research Supervision Process

Mahathir Mahfordz, Norizan Mohd Yasin
Faculty of Computer Science and Information Technology
University of Malaya, Kuala Lumpur, Malaysia
mrdell_06@yahoo.com, norizan@um.edu.my

Abstract
This research focuses on the communication aspect of research supervision between the students and supervisors at the Faculty of Computer Science and Information Technology (FCSIT), University of Malaya (UM). Mixed method approaches were conducted in this study; survey questionnaire and interview. In particular, various problems were identified during the communication process among them, which time constraint is one of it. A web-based system has been proposed whereby the supervisors can manage and keep track the research progress of the students, and believe that it will help to improve the communication between them, hence facilitate the research supervision process at FCSIT.

Keywords
Research supervision, postgraduate, web-based system.

INTRODUCTION

Since its inception on September 22, 1994, in keeping with UM motto "The Leader in Research & Innovation", FCSIT strengthen itself with the vision to be an internationally well-known centre of excellence in research and education in Computer Science and Information Technology. As stated in University of Malaya (Master's Degree) Rules and Regulations 2001 and University of Malaya (Degree of Doctor of Philosophy) Rules and Regulation 2007, for the students who enrolled in the programmes of study which consist of dissertation part, e.g: Master's Degree by Coursework and Dissertation, Master's Degree by Dissertation and Doctor of Philosophy, they need to submit the dissertation at the end of their postgraduate candidature as a requirement for the degree completion. The faculty shall appoint at least one supervisor for each student for the research component of the respective degree programmes. (In this study, the term thesis also implies dissertations and special research projects required for graduation.)

The research produced by the students keep increasing in numbers from year to year, corresponding the numbers of enrolled postgraduates in FCSIT. Due to the increasing number of students, supervisors are required to supervise more research students than they have in the past. For that reason, various researches have shown several concerns about research supervision, especially in postgraduate environment. Postgraduate supervision would appear to be an international issue [10].

BACKGROUND

Currently, there is no specific web-based system for the supervisors to manage their students' research progress, and they still use the manual way in order to communicate with them. Therefore, FCSIT need to be more efficient in their management; one of the ways is to implement a computerized system where this system is being proposed. So, this web-based system has been proposed to create new communication medium and styles that affect the activities between supervisors and the students under their supervision.

LITERATURE REVIEW

Communication Connection

There is a need of connection between supervisor and student during the research completion process. It may generate communication between multiple parties; either one-to-one or one-to-many.

The role of other students in providing support is significant to the completion of thesis. Many students study part time and have little access to fellow students. Providing support for small groups of students with similar interests, or maybe other discipline areas can be helpful. It offers students the opportunity to communicate effectively and learn from each other. Student panels can also organize to exchange literature searches, research proposals, subject materials etc. Peers are an excellent source of feedback and schools may offer postgraduate seminars to facilitate this need. Technology can assist interactions [1].

Most of the part time students were not able to meet their supervisor regularly like other full time students due to the time constraint. Unsmooth communication causes difficulties for both parties to create intellectual environment, hence prolong the time of thesis completion. They have to communicate regularly and understand each other's requirement and expectation. The quality of supervision process could be improved by enhancing the communication between students and supervisors.

Creation of Online Supervision

People join an online community because they have a shared goal, interest, or need [13]. Online or virtual communities are best described as communities that exist in a computer mediated space, which have built up relationships between community members, and whose activities are supported by information and communication technology, see for instance Carver [2], Craig and Zimring [3], Erickson [4], Hagel and Armstrong [5], Hesse [6], Ho, et al. [7], Jones and Rafaeli [8], Rheingold [11], Romm and Clarke [12]. The contribution of electronic communication can be in online supervision provision which allows continuity of supervision even when a supervisor has left an institute and allows enrolment with the most suited supervisor irrespective of where he/she is located in the world; and in the provision of online exemplars to guide the researcher [1] [9].

Web Review and Analysis

The comparisons in Table 1 mentioned about the strengths and weaknesses for each web-based systems.

Table 1. Comparisons of strengths and weaknesses among various web-based systems

Strengths	Weaknesses
UM Moodle http://adec.um.edu.my/main/	
• Good modules arrangements. • Updated bulletins. • Lecturers and students can communicate through forum. • Students are able to know their progress marks for each subject.	• Crowded information. • A few unused links. • Documentation for new user is not provided.
Sistem Penasihat Akademik UM https://isis.um.edu.my/pa/	
• Attractive interfaces. • Lecturers are able to know the details of their supervised students, such as CGPA and majoring. • Lecturers are able to comment on each of their students' performance. • Lecturers are able to keep track of their students' progress; in terms of academic matters.	• Student cannot view this system. • Lecturers and students cannot communicate between each other. • Faculty's management are not able to view overall progress report of the students.
i-Learn UiTM http://i-learn.uitm.edu.my/	
• Good modules arrangements. • Video • Students can interact with each other. • Lecturers and students can communicate through email and forum. • Documentation for new user is provided.	• Unattractive interfaces. • Crowded information link items. • Documentation for new user is not provided.
SMPWEB UKM http://smp.ukm.my/smpweb/	
• Attractive interfaces. • Good modules arrangements. • Students can register for courses and thesis, check examination result. • Academic personnel can view students list, retrieve and print report.	• Inefficient modules arrangement. • Many irrelevant links. • Slow page performances.
UKM SPIN *http://spin.medic.ukm.my/*	
• Attractive interfaces. • Many modules are provided, such as online quizzes and past year model questions. • Lecturers and students can communicate through forum and discussion boards. • Documentation for new user is provided.	• Information is not updated. • Students are not able to know their course mates; in order to do more discussion on the specific subject.
USM Engineering E-Learning http://moodle.eng.usm.my/	
• Documentation for new user is provided. • Lecturers and students can communicate through email and forum. • Students are able to know their progress marks for each subject.	• A few unused links. • Unattractive interfaces. • Slow page performance. • Inefficient modules arrangement.

These comparisons resulted from the discussion and opinion from the personnel that have used the web systems.
Table 2 below shows the modules comparison from six web-based systems. There are four common modules that available in that systems, which are login/logout, documents upload/download, forum/discussion board and latest news/announcement.

Table 2. Comparisons of modules available among various web-based systems

Web systems	UM Moodle	Sistem Penasihat Akademik UM	i-Learn UiTM	SMPWEB UKM	UKM SPIN	USM Engineering E-Learning
Login/logout	✓	✓	✓	✓	✓	✓
Documents upload/download	✓	×	✓	×	✓	✓
Forum/discussion board	✓	×	✓	×	✓	✓
Latest news/announcement	✓	✓	✓	×	✓	✓
Course registration	×	×	×	✓	×	×
Quiz/tutorial centre	×	×	×	×	✓	×
Thesis registration	×	×	×	✓	×	×
User tracking	✓	×	×	×	×	✓
Survey	×	×	×	×	×	✓
Search	✓	×	×	×	×	×

All aspects of comparison have been reviewed and taken into consideration for developing a functional web based system. Good modules arrangement, updated information, attractive interfaces and two-way communication platform attract more user to use the web system frequently.

RESEARCH METHODOLOGY

Mixed-method approaches were selected in this research; survey questionnaire and interview. It requires the respondents; 50 postgraduate students, seven supervisors and a faculty administration to give feedback about the current communication methods, problems arise during research supervision process and the requirements which will be implemented into the web-based system to be developed for FCSIT.

DATA ANALYSIS AND FINDINGS

Analysis of the data collected from the survey indicates that most of the respondents were not satisfied with the current communication methods; such as using instant messenger (e.g.: Yahoo Messenger), email or telephone call. They explain the reason regarding their answer:

- Difficulty in confirming the appointments.
- Supervisor do not has enough time to meet properly, busy with other tasks.
- No specific communication channel; supervisors were felt interrupted and hard to communicate.
- Supervisor took a long time to give the feedback.

Time constraint was the main problem during the communication process, followed by supervisor's/student's availability, discipline or self-awareness, and other types of problems. It shows that students and supervisors are not able to meet each other regularly due to the problems arise.
Based on the scenario above, majority of the respondents agree that there should be a specific system whereby the supervisors can manage and keep track the research progress of their students. Both parties will get updated from each other in a systematic way. They can communicate through specific channel without feel interrupted to meet face-to-face regularly; hence better time consumption. Furthermore, 98% of the students want the specific channel to submit their current research progress to their supervisor. All suggested modules; online submission, news and announcement, downloadable forms and documents, and forum are considered for the system development phase.

DISCUSSION

Communication aspect

Some students faced difficulties during the communication process; especially in confirming the appointments session. Sometimes supervisors have to attend meeting, courses, seminars or conferences which will delay the communication planned happen. Supervisors also had difficulties to reach their students if they have to suddenly cancel the meeting appointment, to find students who are not progress well in their research and occasionally both parties missed the scheduled appointment. Most of the local students in FCSIT are part-time students who are not able to meet regularly due to works responsibility. There is certain cases where the supervisor has to work overtime (exceeding the office hours) for waiting the students to come to the faculty.
With no specific communication channel and busy with workloads, supervisors were felt interrupted and hard to communicate properly with their students. Students always prefer to get direct feedbacks from their supervisor, rather than keep waiting. So this proposed web-based system will ease the communication process, it may help to simplify the supervision process.

Conceptual Framework

This research aims to develop a web based system that can manage and keep track the research progress of the students under their respective supervisor. As shown in figure 1, this system will provide an effective way to support the communication process between supervisor and student. Every comments and feedbacks for every report and chapter submission will be kept in this system for future reference. Other than that, this system will help on the administrative side by providing tools for collecting, managing and documenting data. By the way, other important approaches such as supervision style, intellectual

environment which surrounding the research culture, research facilities, student motivation, access to data collection and university policy also contribute to the completion of research on time. This process will nurture the development of communities of interest thus enhancing research productivity.

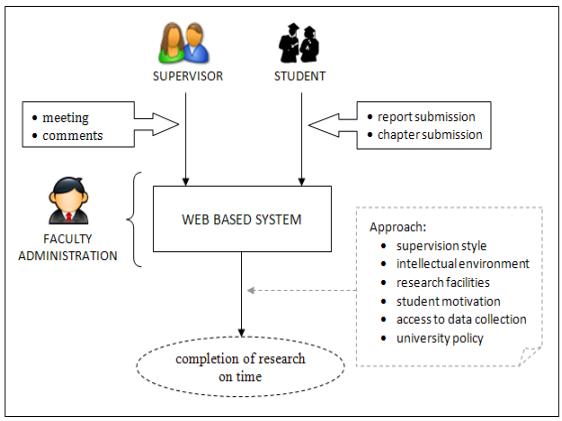


Figure 1. Conceptual framework of a web-based system for research supervision

Conclusion

Creation of integration an environment where the integration of technology is possible will change the way that supervisor communicates with their students. In the same time, it is also will change the work that supervisor do. The management of the faculty will become more efficient in term of administrative side of postgraduate supervision process.

ACKNOWLEDGMENTS

Deepest appreciation goes to the Government of Malaysia, Majlis Amanah Rakyat (MARA) and Institute of Research Management and Monitoring (IPPP), University of Malaya who gave financial support which had made this research easier. Not forgotten to the respondents involved in the data collection process for their cooperation and willingness to participate in this research.

This work is part of master's dissertation in the Faculty of Computer Science and Information Technology, University of Malaya, Kuala Lumpur, Malaysia.

REFERENCES

[1] Buttery, E. A., Richter, E. M., & Filho, W. L., An overview of the elements that influence efficiency in postgraduate supervisory practice arrangements. *International Journal of Educational Management*, 19(1), (2005), 7-26.

[2] Carver, C. "Building a Virtual Community for a Tele-Learning Environment," *IEEE Communication Magazine*, 37(3), (1999), 114-118.

[3] Craig, D.L. and Zimring, C. "Supporting Collaborative Design Groups as Design Communities," *Design Studies*, 21(2), (2000), 187-204.

[4] Erickson, T. "Social Interaction on the Net: Virtual community as Participatory Genre," *Proceedings of the 30th Hawaii International Conference on System Sciences,* (1997), 13-21.

[5] Hagel, J. and Armstrong, A.G. Net Gain: Expanding Markets through Virtual Communities, Harvard Business School Press, Boston, Massachusetts, (1997).

[6] Hesse, B.W. "Curb Cuts in the Virtual Community: Telework and Persons with Disabilities," *Proceedings of the 28th Annual Hawaii International Conference on System Sciences*, (1995), 418-425.

[7] Ho, J., Schraefel, M.C. and Chignell, M. "Towards an Evaluation Methodology for the Development of Research-Oriented Virtual Communities," *Proceedings of the 9th International Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises*, (2000), 112-117.

[8] Jones, Q. and Rafaeli, S. "Time to Split, Virtually: 'Discourse Architecture' and 'Community Building' as means to Creating Vibrant Virtual Metro-polises," *Electronic Markets: International Journal of Electronic Commerce & Business Media* 10(4), (2000), 214-223.

[9] Love, T., "New directions in PhDs: online considerations", (2001), available at: www.love.com.au/papers/Newdir_phd/Newdir_phd.htm (accessed 10 March 2004).

[10] Pearson, M., Evans, T., & Macauley, P., 'Editorial: The working life of doctoral students: Challenges for research education and training', *Studies in Continuing Education*, vol. 26, (2004), 347–352.

[11] Rheingold, H. The Virtual Community: Homesteading on the Electronic Frontier, Addison Wesley, London, England, (1993).

[12] Romm, C. and Clarke, R.J. "Virtual Community Research Themes: A Pre-liminary Draft for A Comprehensive Model," *Proceedings of the 6th Australasian Conference on Information Systems*, Curtin University, Perth, Australia, (1995), 57-70.

[13] Whittaker, S., Isaacs, E. and O'Day, V. "Widening the Net," *SIGCHI Bulletin* (29:3), (1997) 27-30.

Antibiotic and Heavy Metal Resistance of Bacteria Isolated from Mud Crab (*Scylla* spp.)

Syahrizawati, M.Z.C, Lee, S.W., Nurdiana, R.
Department of Agro Industry, Faculty of Agro Industry and Natural Resources, Universiti Malaysia Kelantan, Bag Locked 36, 16100 Pengkalan Chepa, Kelantan, Malaysia
sheriee_23@yahoo.com

Abstract
A total of 34 bacterial isolates isolated from marketable size of mud crab (Scylla spp.). The bacterial isolated were Aeromonas spp, Edwardsiella tarda, Vibrio alginolyticus, Vibrio parahaemolyticus, Salmonella spp. and Klebsiella spp. All the bacterial isolated were tested for antibiotic susceptibility against 16 types of antibiotics using disk diffusion method. From the result showed that the majority of the bacterial isolates were found sensitive to nalidixic acid, flumequine and oxytetracycline with 100% of bacterial types were sensitive to this antibiotics. Most of bacterial isolates were resistant to sulphamethoxazole and ampicillin with 62.5% and 68.8% respectively. For overall, the total of sensitive case was reported to be higher than the resistance case and followed by intermediate sensitive case in which sensitive case (72.7%), resistance case (19.7%) and intermediate sensitive case (7.4%). The Multiple Antibiotic Resistance (MAR) values were range of 0.03 to 0.29 in which Aeromonas spp. (0.29) showed the highest value from all the bacterial isolates followed by Salmonella spp. and Klebsiella spp. (0.21), Edwardsiella tarda (0.20), Vibrio alginolyticus (0.09) and Vibrio parahaemolyticus (0.03) showed the lowest value. These MAR values were indicated that bacterial isolates from wild Scylla spp. were seldom or never used for the animal in term of treatment to the tested antibiotics. In addition, heavy metal resistance was demonstrated by these present bacterial isolates. All bacterial isolates were found resistance to all concentrations of Cr^{6+}. Meanwhile, Hg^{2+} at concentration of 20 to 40 μg mL^{-1} showed that all bacterial isolates were sensitive to this heavy metal. Zn^{2+} found can be inhibited totally the Klebsiella spp at all concentrations. On the other hand, all the bacterial isolates were not present on Zn^{2+} at concentration of 400 μg mL^{-1}.

Keywords
Scylla spp., antibiotic, heavy metal, MAR index

INTRODUCTION

Scylla spp., also called serrated swimming crab, giant mud crab and edible mud crab has been identified as a potential aquaculture species [9]. They are usually found in intertidal and subtidal zones of estuaries and in mangrove system. Aquaculture is subject to a range of widespread bacterial diseases, which reduce its efficiency. Antibiotic is a substances produced by micro-organisms that are capable of destroying bacteria or inhibit their growth. Antimicrobial agents used in aquaculture are to control the losses in culture system. There are a few reports in mud crab antibiotic resistant. Nowadays, a wide range of antimicrobial compound (e.g. oxytetracycline, ciprofloxacin, nitrofurantoin, furazolidone or chloramphenicol) being used in the hatcheries and farm to control bacterial population [4; 1; 10]. Bacterial resistance to antibiotics is an emerging public health concern. The tendency use antibacterial and other chemical due to increasing of seed losses. The introduction of heavy metals (eg: Fe, Zn, Mn, Co, Ni, V, Mo) into environment can cause considerable modification in the structure and fraction of microbial communities [3]. [6] reported that all aquatic invertebrates accumulate trace metals in their tissues, whether or not these metals are essential to metabolism. Recently, there is little information available on antibiogram and heavy metal resistance profile of bacterial isolates from mud crab in the world. Thus, this study was carried out to characterization of luminescent bacteria that may be useful for *Scylla* spp. health management in captivity. Furthermore, to determine the effectiveness antibiotics and heavy metal resistance profile to control bacterial disease in *Scylla* spp.

MATERIALS AND METHODS

Bacterial from the mud crab were immediately isolates on external and internal part of body using the spread plate technique with five types of agar plate medium used as follows: Thiosulphate Citrate Bile Salt (TCBS), Mac Conkey, Cytophaga Agar (CA), Xylose Lysine Deoxycholate (XLD) and Glutamate Starch Pseudomonas (GSP) and incubated at room temperature for 24 to 48 hours. The bacterial colonies that growth on the selective media will further selected for the identification test. Antibiotic susceptibility test were performed according to Kirby-Bauer disk diffusion method. Bacterial were selected from the plates and were cultured in Tryptic Soy Agar (TSA) deep tube for 18 to 24 hours at room temperature. The bacterial inoculums were swab onto Trypticase Soy Agar (TSA). Antibiotics were tested including nalidixic acid (30 μg), oxolinic acid (2 μg), compound sulphonamides (300 μg), doxycycline (30 μg), tetracycline (30 μg), novobiocin (30 μg), chloramphenicol (30 μg), kanamycin (30 μg), sulphamethoxazole (25 μg), flumequine (30 μg), erythromycin (15 μg), ampicillin (10 μg), spiramycin

(100 µg), oxytetracycline (30 µg), amoxycillin (25 µg) and fosfomycin (50 µg) (Oxoid, England). The diameter (in mm) of inhibit zone that produced from each antibiotic disk were measured. Interpretation of the results namely as sensitive (S), intermediary sensitive (I) and resistance (R) according to the reference to the standard provided by the National Committee for Clinical Laboratory Standards (CLSI 2006) with *Escherichia coli* ATCC 25922 as quality control. Multiple Antibiotic Resistance (MAR) Index of all the present isolates against the 16 tested antibiotics were calculated based on the formula as follows:

MAR Index = X / (Y x Z)

X = total of antibiotic resistance case;
Y = total of antibiotic used in the study;
Z = total of isolates

A MAR Index value of equal or less than 0.2 were defined as those antibiotics were seldom or never used for the animal in term of treatment whereas the MAR Index value higher than 0.2 is considered that animal have received high risk exposure to those antibiotics. The heavy metal resistance test was conducted by agar dilutions method with bacterial tolerance to four elements of heavy metal as follows: mercury (Hg^{2+}) chromium (Cr^{6+}), copper (Cu^{2+}) and Zinc (Zn^{2+}). Bacteria suspension was spread onto the Trypticase Soy Agar (TSA) medium of Kalium Dichromate ($K_2Cr_2O_7$), Zinc Sulphate ($ZnSO_4$), Copper II Sulphate ($CuSO_4$) and Mercury II Chloride ($HgCl_2$) (Merck, Germany) for overnight in five different concentrations. The concentration for Zn^{2+} and Cr^{6+} was ranging from 25 to 400 µg mL^{-1} while the concentration of Hg^{2+} and Cu^{2+} was ranging from 2.5 to 40 µg mL^{-1} and 150 to 2 400 µg mL^{-1}, respectively. The bacterial were considered resistant if they were able to grow at concentrations of 10 µg mL^{-1} Hg^{2+}, 100 µg mL^{-1} Cr^{6+} and 600 µg $mL^{-1}Cu^{2+}$.

RESULTS

Table 1 Percentage of sensitivity of present bacterial isolates against 16 types of antibiotics

Antibiotic (µg)	Resistance (%)	Intermediary sensitive (%)	Sensitive (%)
NA (30)	0.0	0.0	100.0
OA (2)	6.3	3.1	90.6
S3 (300)	15.6	0.0	84.4
DO (30)	3.1	3.1	93.8
TE (30)	3.1	0.0	96.9
NV (30)	50.0	12.5	37.5
C (30)	12.5	0.0	87.5
K (30)	0.0	3.1	96.9
RL (25)	62.5	21.9	15.6
UB (30)	0.0	0.0	100.0
E (15)	6.3	18.8	75.0
AMP (10)	68.8	18.8	12.5
SP (100)	21.9	28.1	50.0
OT (30)	0.0	0.0	100.0
AML (25)	40.6	21.9	37.5
FOS (50)	28.1	0.0	71.9

Nalidixic acid 30 µg (NA); Oxolinic acid 2 µg (OA); Compound sulphonamides 300 µg (S3); Doxycycline 30 µg (DO); Tetracycline 30 µg (TE); Novobiocin 30 µg (NV); Chloramphenicol 30 µg (C); Kanamycin 30 µg (K); Sulphamethoxazole 25 µg (RL); Flumequine 30 µg (UB); Erythromycin 15 µg (E); Ampicillin 10 µg (AMP); Spiramycin 100 µg (SP); Oxytetracycline 30 µg (OT); Amoxycillin 25 µg (AML); Fosfomycin 50 µg (FOS).

Table 2 Multiple antibiotic resistance (MAR) value of bacterial isolates from *Scylla* spp.

Bacterial isolates	MAR value
Aeromonas spp	0.29
Edwardsiella tarda	0.20
Vibrio alginolyticus	0.09
Vibrio parahaemolyticus	0.03
Salmonella spp	0.21
Klebsiella spp	0.21

DISCUSSION

The experiments described were designed to characterize the luminous bacteria and to determine the distribution of heavy metal and antibiotic resistance of bacterial isolates from wild *Scylla* spp. marketable size. The information concerning the bacterial flora of crustaceans, particularly mud crab, appears to be limited. Therefore, in this study, the sensitivity of 16 types of antibiotics and four types of heavy metals with five different concentrations were determined. The successful bacterial isolates from mud crab were *Aeromonas* spp*, Edwardsiella tarda, Vibrio alginolyticus, Vibrio parahaemolyticus, Salmonella* spp and *Klebsiella* spp. *Vibrio* spp are pathogenic due to environmental stress on the host, can have devastating effects on marine and brackish water culture of fish. *Vibrio* species have been found to be a serious problem in the aquaculture especially in hatcheries and farms of marine shrimp and freshwater prawn. Therefore, it is necessary to control the bacterial population in the hatcheries to minimize the danger of bacterial infections. Similarly, several *Aeromonas* spp. are associated with fish diseases. Many hatcheries use antibiotics as prophylactic agents to prevent bacterial infection of larvae. However, [4] reported that the antibiotics used in the hatchery were ineffective in controlling luminous bacteria as antibiotic resistant. A wide range of antimicrobial compounds is now being used in the hatcheries and farms of freshwater prawn and marine shrimp in to control bacterial population [4; 1; 10]. The use of antibiotics has been found to be effective in controlling

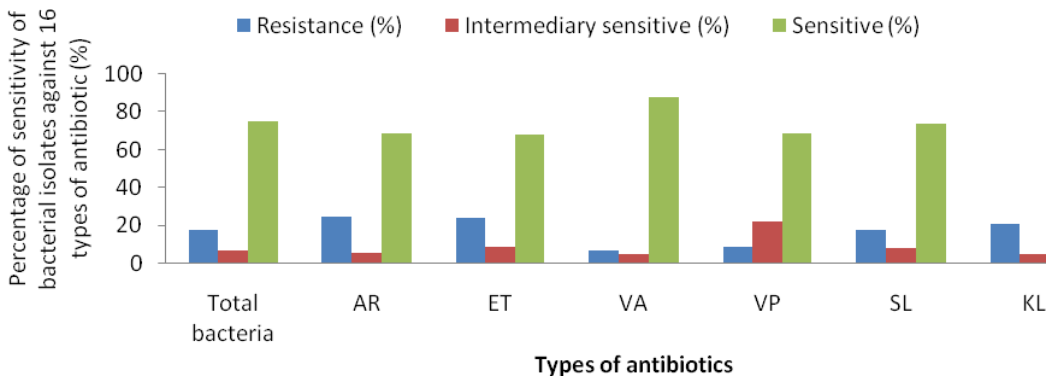


Figure 1 Antibiotics sensitivity patterns of bacterial isolates from *Scylla* spp. Total bacterial (n=34), AR=*Aeromonas* spp.; ET=*Edwardsiella tarda*; VA=*Vibrio alginolyticus*; VP=*Vibrio parahaemolyticus*; SL=*Salmonella* spp.; KL=*Klebsiella* spp.

the bacterial infections of crustaceans [10]. More than 60% of the bacterial isolates isolated from the mud crab showed resistance to ampicillin and sulphamethoxazole. The incidence of resistance to some antibiotics and heavy metals in the bacterial strains used in this study would suggest an increasing input of antimicrobial agents into mud crab, probably as a consequence of the disposal of untreated sewage, industrial wastes and agricultural activities. The use of antimicrobial agents in the control of losses in fish farming presents a number of features that are rarely encountered in the treatment of humans or of large land-based animals. [11] defined the trace metals as those metals that occur in trace amounts within the environment or within organisms. Marine invertebrates accumulate trace metals to varying degrees and body concentrations may reach very high levels [12; 2; 8]. According to [6], many trace metals cannot be immediately excreted or detoxified, for they are required to play essential roles in metabolism. Zinc for example is a key component of many enzymes including carbonic anhydrase, and copperis a functional part of the respiratory protein haemocyanin, found in certain molluscs and arthropods, particularly malacostracan crustaceans. From the result, Zn^{2+} at concentration of 400 µg $mL^{-1}$and Hg^{2+} at concentration of 20 to 40 µg mL^{-1}, bacterial isolates were showed sensitive to these heavy metals. All the tested heavy metals (Cr^{6+}, Zn^{2+}, Cu^{2+} and Hg^{2+}) showed not totally inhibit all the concentrations. Heavy metals, such as Be, Cd, Cr, Co, Pb, Mn, Hg, Mo, Ni, Se and Zn should be considered potentially harmful if their individual concentrations exceed 0.1 ppm. [5] According to [7], carbon compounds, nutrients and heavy metals that are delivered to the ocean margin are important in the living processes of marine organisms. However, they are a potential source of contamination as well. Marine animals are sensitive to metals when the concentrations of these substances reach a certain level in the water. The result of this study showed that the wild mud crab was very few contaminated with antibiotic and highly resistance to heavy metal residues. In conclusion, the results of this study showed that antibiotic resistance occurred at moderate level among bacterial isolated from mud crab. Furthermore, MAR index value indicated that these antibiotics were seldom or never used for the animal in term of treatment. In additional, alternatives to antibiotics should be explored for aquaculture industry development to ensure its sustainability and food safety. Besides that, further studies should be carried out to reveal the incidence of antibiotics and heavy metal resistance among the bacterial concerning the possible risks to mud crab and public health.

ACKNOWLEDGMENTS

This project was funded by Universiti Malaysia Kelantan, Malaysia and Ministry of Science, Technology and Inovation (MOSTI).

REFERENCES

[1] Abraham, T.J., Manely, R., Palaniappan, R., Devendaran, K., 1997. Pathogenicity and antibiotic sensitivity of luminous Vibrio harveyi isolated from diseased penaeid shrimp. J. *Aquat. Trop*. 12 (1), 1 – 8.

[2] Bryan, G. W. 1979. Bioaccumulation of marine pollutants. *Philosophical Transactions of the royal society*, B. 286: 483-505.

[3] Doelman P, Jansen E, Michels M, Van TM. 1994. Effects of heavy metals in soil on microbial diversty and activity as shown by the sensitivity–resistance index, an ecologically relevant parameter. *Biol Fertil Soil*. 17:177–84.

[4] Karunasagar, I., Pai, R., Malathi, G.R., Karunasagar, I., 1994. Mass mortality of Penaeus monodon larvae due to antibiotic resistant Vibrio harveyi infection. *Aquaculture* 128, 203–209.

[5] Parker, R. (1995). Aquaculture science. New York: Delmar.

[6] Philip S. R. 2002. Trace metal concentrations in aquatic invertebrates: why and so what. *Environmental Pollution*. 120: 497–507.

[7] Phillips, D. J. H., and Rainbow, P. S. 1993. Biomonitoring of trace aquatic contaminants. Barking, UK: Elsevier Science.

[8] Prosi, F. 1979. Heavy metals in aquatic organisms. In *Metal Pollutant in the Aquatic Environment* (Forstner, U. & Wittman, G. W. T., eds). Springer, Berlin. Pp. 271-323.

[9] Robertson, W. D. 1996. Abundance, population structure and size at maturity of *Scylla serrata* (Forskal) (Decapoda : Portunidae) in Eastern Cape estuaries, South Africa. South Afr. *J. Zool*. 31(4): 177-185.

[10] Sahul Hameed, A.S., Balasubramanian, G., 2000. Antibiotic resistance in bacteria isolated from Artemia nauplii and efficacy of formaldehyde to control bacterial load. *Aquaculture* 183, 195–205.

[11] Wittman, G.T.W., 1979. Toxic metals. In: Forstner, U., Wittmann, G.T.W. (Eds.), *Metal Pollution in the Aquatic Environment*. Springer Verlag, Berlin, pp. 3 – 70.

[12] Wright, D. A. 1978. Heavy metal accumulation by aquatic invertebrates. *Applied Biology*. 3: 331-394.

Antioxidant in Natural Blue Color of *Gynochthodes sublanceolata* (Pitang Leaves)

Ahmad Afif bin Mohd Anuar and Awang Soh bin Mamat
Faculty Agro Industry & Natural Resouses
Universiti Malaysia Kelantan
*nurisah87@yahoo.com.my

Abstract
Gynochthodes sublanceolata express several color due to present of various pigments. Extraction of the leaves produce a dark-purplish color and analysis of the extract shows higher antioxidant properties with percentage of DPPH inhibition (75.7 ± 0.05). In conclusion, Gynochthodes sublanceolata seem to have high potential as food colorant which provide beneficial values such as antioxidant which not provided by synthetic coloring.

Keywords
Gynochthodes sublanceolata, Antioxidant, Anthocyanin.

INTRODUCTION

Pitang leaves (*Gynochthodes sublanceolata*) are from the family of Rubiaceae and originated fromThailand. It is a glabrous woody climber with stems several meters long, branches terete, and shiny dark blackishbrown when dry. Pitang leaves are considered as a rare plant and hard to find. Mostly found in the southern of Thailand such as Songkhla, Pattani, Narathiwat. It has been used as a food colorant for nasi kerabu in Kelantan (east-coast of Peninsular Malaysia) resulting the rice to be dark-purplish in color.

Plants pigments such as chlorophyll, xantophyll, carotene, flavone, flavonol, and anthocyanin are responsible for the colors of plant tissues. Chlorophyll pigments possessed by *G. sublanceolata* allow photosynthesis process to occur at the cellular level, allowing plants to appear green in color [1]. Chlorophyll[1] is not a very stable compound, and can be destroyed due to temperature and pH changes [2]. However, as chlorophyll destroyed, the other pigments such as carotenoid and anthocyanin are shown [1].

The color of the anthocyanin[2] can be influenced by pH [3]. The anthocyanin turns into bright pink in acidic solution, reddish-purple in neutral solutions and green in alkaline or basic solutions [4]. Anthocyanins are antioxidant flavonoids that can influence positively on health condition. Antioxidant supplementation can block NF-kB activation and may inhibit NF-kB activity. Since NF-kB seem to link to cancer and inflammantory, thus it plays important role to inhibit cancer and inflammantory through mechanisms distinct from redox regulation [5]

MATERIAL AND METHOD

Sample Collection

G. sublanceolata samples were collected from Tumpat, Kelantan. The samples were stored and transferred laboratory at Universiti Malaysia Kelantan (UMK).

.

Sample Extraction

The Pitang leaves samples were blended in mixture of methanol: water (50% v/v + 0.1 % HCl). Then, the solvent will be removed from samples using rotary evaporator/rotavap (Büchi, Switzerland). Freeze dryer will be used to transform the samples into powder form.

ANALYSIS

DPPH free radical scavenging

Radical scavenging activity of the plant extracts against stable DPPH (2,2-diphenyl-2-picrylhydrazyl hydrate, sigma-Aldirich Chemie, Steinheim, Germany) was determined spectrophotomatrically. When DPPH reacts with an antioxidant compound, which can donate hydrogen, it is reduced. The changes in color (from deep-violet to light-yellow) were measured at 517 nm wavelength. Extract stock solutions was prepared in 100 mg/ml in ethanol. Methanol extract was not soluble in ethanol (even after treating solutions for 5 min in an ultrasonic bath), therefore it is dissolved in dimethylsulphoxide. The working solution was prepared using methanol in a concentration of 500 µg/ml. the solution of DPPH in methanol 2.5 mg/ml was prepared daily, before UV measurements. 5 µl of this solution was mixed with 100 µl extract solution 96 wells plate. The samples will be kept in the dark for 30 min at ambient temperature and then the decrease in absorption will be measured by using microtitre plate reader (Labsystems iEMS Reader MF). Absorption of blank sample containing the same amount of methanol and DPPH solution as prepared and measured. The experiments will be carried out triplicate.

[1] Chlorophyll is the molecule that absorbs sunlight and uses its energy to synthesise carbohydrates from CO2 and water.
[2] Anthocyanins are natural colorants belonging to the flavonoid family.
[3] NF-kB has constitutively activated in prostate cancer cells.

RESULTS AND DISCUSSION

The extracts of *G. sublanceolata* give rise to blue-indigo liquid solution which can be used as natural food colorant. The use of the pitang leaves as natural food colorants have more advantages compared to synthetic/artifcial coloring such as tartrazine and amaranth. Natural food coloring can provide beneficial values that synthetic coloring do not provide. Furthermore, FDA also has stricter the use of synthetic coloring for food coloring agent.

Analysis of the extract shows higher antioxidant properties with percentage of DPPH inhibition (75.7 ± 0.05) compare to *Salacca edulis* (salak fruit), *Hylocerous polyrhizus* (red pitaya), and *Ipomea batatas* L. (purple sweet potato). The high level content of antioxidant in pitang leaves contribute major advantage to medicinal purposes. NF-kB (nuclear factor kappa-light-chain-enhancer of activated B cells) is a protein complex that controls the transcription of DNA. NF-kB plays a key role in regulating the immune response to infection. Conversely, incorrect regulation of NF-kB has been linked to cancer. The nuclear factor (NF-kB) proposed to be a pivotal protein in the link between inflammation and cancer [6]. NF-kB characterizes all inflammatory responses and is also a major hallmark of tumors [7]. Antioxidant supplementation can block NF-kB activation and inhibit NF-kB activity through mechanisms distinct from redox regulation [5]

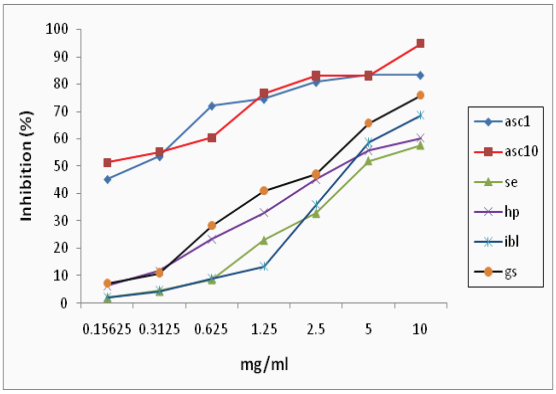


Figure 1. Antioxidant properties of *Gynochthodes sublanceolata* (gs) compared to *Salacca edulis* (salak fruit) (se), *Hylocerous polyrhizus* (red pitaya) (hp), and *Ipomea batatas* L. (purple sweet potato) (Ibl) determined by DPPH.

CONCLUSION

Gynochthodes subalanceolata seem to have high potential for food industrial and medical value. As food colorant, *G. sublanceolata* can provide beneficial values such as antioxidant which not provided by synthetic coloring. Further research regarding antioxidant contents which can contribute to medical purpose such as anti-inflammantory and anti-cancer from *G. sublanceolata* was needed.

ACKNOWLEDGMENTS

The author is grateful to the Faculty of Agro Industry and Natural Resources for providing space and facilities to carry out the study. This study was funded by the University Malaysia Kelantan and my grateful thanks are extended to my supervisor Prof. Dr. Awang Soh Mamat for his supports and ideas.

REFERENCES

[1] L.Thompson, What Substance Gives Plants Their Green Color? http:wwwwehow.com/how-does 5470613 substance-gives-plants-green-color.html (2009) [12 October 2010]

[2] K.Blakesley. Peak Fall Colors:Why Do Leaves Change Color? http://webchace.googleusercontent.com/search?q=cache:yXAaAmRgvSQJ:www.associatedcontent.com/article/224519/peak fall colors why do leaveschange.html+factor+destroying+chlorophyll &cd=1&cd=1&hl=en&ct=clnk&client=firefox-a (2009) [12 October 2010]

[3] D. M. Holcorft, A. A. Kader. Carbon Dioxide-Induced Changes in color and Anthocyanin Synthesis of Stored Strawberry Fruit. *HortScience* 36(7) (1999) 1244-1248

[4] C.Romero and R.Bakker. Interaction Between Grape Anthocyanins and Pyruvic Acid, with Effect of pH and Acid Concentration on Anthocyanin Composition and Color in Model Solutions Interaction. *Journal of Agriculture Food Chemical.* 47 (8) (1999) 3130–3139

[5] S.Huang, C.A.Pettaway, H.Uehara, C.D. Bucana, & I.J.Fidler. Blockade of NF-kB activity in human prostate cancer cells is associated with suppression of angiogenesis, invasion, and metastasis. *Oncogene* 20 (2001) 4188 - 4197

[6] C.Y.Wang, M.W.Mayo, A.S.Baldwin Jr. TNF- and Cancer Therapy-Induced Apoptosis: Potentiation by Inhibition of NF-kappa B *Science* 274 (1996) 784 – 787.

[7] A.Lin and M.Karin. NF-kB in Cancer:a Market Target. *Semin Cancer Biology* 13 (2003) 107-114.

Antibiotic Resistance and Heavy Metal Resistance Patterns in Bacteria Isolated from *Artemia spp.*

Nurdiana Roslan, Lee Seong Wei, Cik Syahrizawati Mohd Zohri
Department of Agro Industry, Faculty of Agro Industry and Natural Resources, Universiti Malaysia Kelantan, Bag Locked 36, 16100 Pengkalan Chepa, Kelantan, Malaysia
binafshadiana@yahoo.com

Abstract
A study was carried out to determine the bacteria heaps of Artemia spp. which are very important live foods for fish larvae and their resistance to the several of antibiotics and heavy metals common used in aquaculture to control bacteria disease from fishes and crustaceans species. The aim of this result was to contribute valuable information for early larvae stage. Vibrio alginolyticus, Vibrio parahaemolyticus, Areomonas spp , Pseudomonas spp., Salmonella spp. Escherichia coli and Flavobacter were bacteria isolated from the Artemia. The bacterium were tested with 16 types of antibiotics by using disc-diffusion for antibiotics susceptibility test. All the antibiotics were used during this study were Nalidixic acid (30µg), Oxolinic acid (2µg), Compound sulphonamides (300µg), Doxycycline (30µg), Tetracycline (30µg), Novobiocin (30µg), Chloramphenicol (30µg), Kanamycin (30µg), Sulphamethoxazole (25µg), Flumequine (30µg), Erythromycin (15µg), Ampicillin (10µg), Spiramycin (100µg), Oxytetracycline (30µg), Amoxycillin (25µg) and Fosfomycin (50µg) (Oxoid, England). Besides that, the heavy-metal resistance of bacteria isolated was determined by using 2-fold agar dilution technique. The result of antibiotic sensitivity also shows that, Sulphamethoxazole (25), Erythomycin (15), Ampicillin (10), Spiramycin(100), Fosfomycin(50) were resistance with 100%. Besides that, Tetracycline (30), Flumequine (30 and Oxytetracycline (30) were recorded as sensitive with 100% respectively. The MAR value recorded at 0.0875, 0.0535, 0.0347, 0.0512, 0.0625, 0.2342, and 0.0781. All bacteria isolate was found sensitive to all concentration of Cr^{6+}, Zn^{2+} and Cu^{2+}. However, Hg^{2+} at concentration 40 µg mL^{-1} showed the bacteria was resistance to this heavy metal. In the cases of all concentration of Chromium Cr^{6+}, the data showed that Pseudomonas spp. can be inhibited totally with this heavy metal.

Key words
Artemia spp., bacteria, antibiotic, heavy metal, MARindex.

INTRODUCTION
Artemia is regarded widely as a kind of important bait and live feed. *Artemia* possess strong adaptability to bad environment and better propagate ability .Its grown-body hold high nourishment, so *Artemia* is excellent bait of fishes, shrimps and crabs (Lavens and Sorgeloos, 2000; Sorgeloos *et al*., 2009). The previous study shown by Rosenberry (1997) and Sorgeloos *et al*., (2007), state that with the development of hatchery aquaculture, the use of brine shrimp *Artemia* as a diet for larval culture of many species became widespread. requirements of various aquatic species (Sorgeloos, 1998;Leger *et al*., 1986; Sorgeloos *et al*.,1998). *Artemia* has high market value and convenience to culture in hatchery.

The brine shrimps carry a large bacterial load may be transferred from live preys into tanks of fish and shellfish larvae (Hameed and Balasubramaniam, 1999). Some of bacteria has been reported in the source of disease and high mortality found in fish larvae and live feed thought to be responsible (Colorni, 1985; Sahul Hameed *at el*., 2002; Samira *et al*., 2006). Furthermore, study of development of antibiotics in bacterial fishes and crustaceans pathogens has also been reported from all areas of aquaculture (Nicolas *et al*., 1989; Karunasagar, 1994; Colorni, 1985; S W Lee, 2009). At present, there is no database on available on antibiogram and heavy metal resistance profile of bacteria from *M. rosernbergii* from hatchery in Malaysia (S W Lee *et al*., 2009). This status issues is also happen to *Artemia sp*. in Malaysia. Thus, the purpose of this present study is to determine the effectiveness antibiotics resistance from bacteria isolated from Artemia nauplii as well as the heavy metal resistance.

MATERIAL AND METHODS
Artemia franciscana from Super Artemia SDN. BHD,Malaysia were employed for this study. The chorion of the cysts was removed employing the methodology proposed by Sorgeloos *et al*.,(1977), a process known as decapsulation. Hatching of the eggs (decapsulated cysts) was performed overnight in a flask with 500 ml of sterile full strength seawater (35ppt), aerated through an air hose connected to an aquarium air pump and maintained at 28 °C in continues light with 1000 lux. After 24h inubation, the instar I nauplii were hatched out from the cysts. The nauplii were feed with rice bran.

About 10 µl was taken from hatched Artemia as subsample in 10 replicates and placed it on 5 media as follows: Tryptic Soy Agar (TSA), Mac Conkey, Thiosulphate Citrate Bile Salt (TCBS), Glutamate

Starch Pseudomonas (GSP), Xylose Lysine Deoxycholate (XLD).

All the inoculated media were incubated at room temperature for 24-48 h. The bacterial colonies that grew on the selective media were further selected for the identification test. The bacterial isolates were identified using conventional biochemical tests (Holt *et al*. 1994) and confirmedwith commercial identification kit (BBL, USA). Antibiotic susceptibility test was carried out according to Kirby-Bauer disk diffusion method using Mueller-Hinton Agar (Bauer *et al*. 1966). Procedures were based on the standardization disc agar diffusion method of the National Committee for Clinical Laboratory Standards for antimicrobial susceptibility tests (Finegold and Martin, 1982). The antibiotics tested were Oxytetracycline (30 µg), Fosfomycin (50 µg), Spiramycin(100 µg), Sulphamethoxazole (25 µg), Compound sulphonamides (300 µg), Novobiocin(30 µg), Oxolinic Acid (2 µg), Kanamycin(30 µg), Tetracycline(30), Amoxycillin(25), Doxycycline(30 µg), Ampicillin (10 µg), Chloramphenicol (30 µg), Flumequine (30 µg), Erythomycin (15µg) and Nalidixic Acid (30 µg).
Interpretation of the results, namely sensitive (S), intermediary sensitive (I), and resistance (R), was made in accordance to the standard measurement of inhibitory zones in millimeter (mm).

The MAR index (multiple antibiotic resistance) was determined for each farm according to Krumperman (1985) and is deWned as $a/(b \cdot c)$ where "*a*" represents the aggregate antibiotic resistance score of all isolates from a farm, "*b*" is the number of antibiotics and "*c*" is the number of isolates from the farm. A MAR index value of less than or equal to 0.2 is considered to indicate from animals in which antibiotics are seldom or never used. A MAR index value greater than 0.2 is considered indicate from a high-risk antibiotic-exposed source. The MAR formula was shown as follow recommended from (Sarter *et al*., 2006):
MAR index=X/(Y×Z)
X=Total of antibiotic resistance case
Y=Total of antibiotics used in the study
Z=Total of isolates

Heavy metal resistance test was carried out as described by Miranda and Castillo (1998). Bacterial tolerance to 4 elements of heavy metal, i.e., mercury (Hg^{2+}), cadmium (Cd^{2+}), chromium (Cr^{6+}), and copper (Cu^{2+}) was determined by agar dilution method. Overnight bacterial suspension was spread onto the plates of TSA medium and incorporated with different concentrations of $HgCl_2$, CdCl, $K_2Cr_2O_7$, and $CuSO_4$ (Fluka, Spain). By 2- fold dilutions, concentration of both Cd^{2+} and Cr^{6+} was ranging from 25 to 400 µg mL-1 while concentration of Hg2+ and Cu2+ was ranging from 2.5 to 40 µg mL-1 and 150 to 2 400 µg mL-1, respectively. For the purpose of defining metal resistance, the isolates were considered to be resistant if growth was obtained at concentration of 100 µg mL-1 Cd^{2+} and Cr^{6+} and 600 µg mL-1 Cu^{2+} (Allen *et al*. 1977).

RESULT

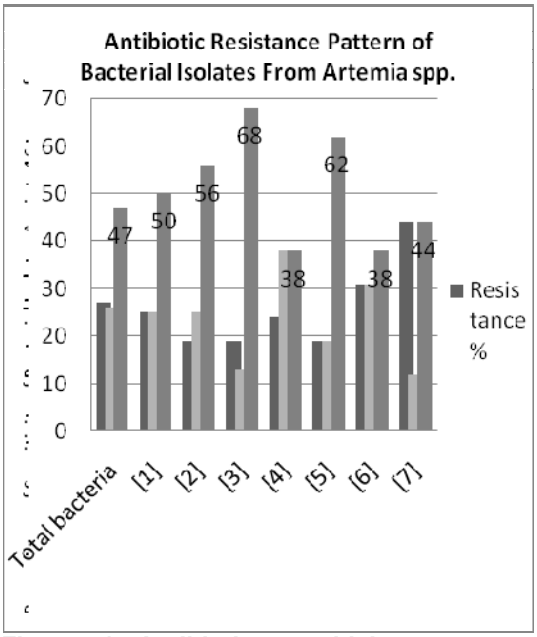


Figure 1 Antibiotic sensitivity pattern of bacterial isolates from Artemia spp.
[1]= *Vibrio alginolyticus* (n=5), [2]= *V. parahaemolytius* (n=7), [3]= *Escherichia coli* (n=9), [4]= *Salmonella spp*. (n=4), [5]= *Aeromonas spp*.(n=7), [6]=*Pseudomonas s*pp (n=6) and [7]=*Flavobacter spp* (n=6).

Table 2 Multiple Antibiotic Resistance (MAR) value of Bacterial Isolates From Artemia spp.

Bacterial Isolates	MAR Value
V. alginolyticus	0.0875
V. parahaemolyticus	0.0535
E. coli	0.0347
Salmonella spp	0.0781
Aeromonas spp	0.0625
Pseudomonas spp	0.2342
Flavobacter spp	0.0512

In this present study, 7 bacteria were isolates from the sample which are *Vibrio alginolyticus, Vibrio parahaemolyticus, Escherichia coli, Salmonella spp., Aeromonas spp., Pseudomonas spp.* and *Flavobacter spp.* The total of resistance cases of this study was 27% whereas the totals of intermediate sensitive and sensitive cases were 26% and 47% respectively (**Fig 1**). Overall the total sensitive case was reported to be higher than resistance and the intermediate sensitive except for *Flavobacter spp.* in which the total of

sensitive cases is similar to resistance cases (44%). In addition, intermediate sensitive cases and sensitive cases in Salmonella spp. show similar results which are 38%. Chloramphenicol was found to be the most effective antibiotic because 83.34% of the present bacterial isolates were sensitive to it. However, in other hand, no bacterial isolates as found sensitive to novobiocin, sulphamethoxazole,erythomycin, ampicilin, spiramycin and amoxicillin. (**Table 1**). In this present study, the MAR value ranged from 0.0347 to 0.2342 in which E.coli shows the lowest MAR value (0.0347) whereas Pseudomonas spp. shows the highest MAR value(0.2342)(**Table 2**). Most of the present bacterial isolates were found sensitive to Cr^{6+} (100%), Cu^{2+} (100%), Hg^{2+} (99.81%) and Zn^{2+} (99.72%) whereas only Salmonella spp. shows that 100% resistance to Cu^{2+} and Hg^{2+}.

In this present study, 7 bacteria were isolates from the sample which are *Vibrio alginolyticus, Vibrio parahaemolyticus, Escherichia coli, Salmonella spp., Aeromonas spp., Pseudomonas spp.* and *Flavobacter spp.* The total of resistance cases of this study was 27% whereas the totals of intermediate sensitive and sensitive cases were 26% and 47% respectively (**Fig 1**). Overall the total sensitive case was reported to be higher than resistance and the intermediate sensitive except for *Flavobacter spp.* in which the total of sensitive cases is similar to resistance cases (44%). In addition, intermediate sensitive cases and sensitive cases in Salmonella spp. show similar results which are 38%. Chloramphenicol was found to be the most effective antibiotic because 83.34% of the present bacterial isolates were sensitive to it. However, in other hand, no bacterial isolates as found sensitive to novobiocin, sulphamethoxazole, erythomycin, ampicilin, spiramycin and amoxicillin. (**Table 1**). In this present study, the MAR value ranged from 0.0347 to 0.2342 in which E.coli shows the lowest MAR value (0.0347) whereas Pseudomonas spp. shows the highest MAR value(0.2342)(**Table 2**). Most of the present bacterial isolates were found sensitive to Cr^{6+} (100%), Cu^{2+} (100%), Hg^{2+} (99.81%) and Zn^{2+} (99.72%) whereas only Salmonella spp. shows that 100% resistance to Cu^{2+} and Hg^{2+}.

Antibiotics (µg)	Resistance (%)	Intermediate Resistance(%)	Sensitive(%)
NA	0	33	67
OA	0	67	33
S3	16.66	16.67	66.66
DO	33.33	50.1	16.66
TE	0	0	100
NV	66.66	33.34	0
C	0	16.66	83.34
K	0	66.66	33.34
RL	100	0	0
UB	0	0	100
E	100	0	0
AMP	100	0	0
SP	100	0	0
OT	0	0	100
AML	100	0	0
FOS	16.66	50	33.34

Table 1 Percentages of senstivity of present bacterial isolates against 16 types of antibiotic

DISCUSSION

According to Puente *et al*., 1992 and Marques *et al*., 2005, stated that Artemia nauplii were found to be highly susceptible to infection by *Vibrio parahaemolyticus*.This is also proved by Austin and Allen (1982) and Iragashi *et al*., (1989). However, during this study, only *Pseudomonas spp.* was the successful bacteria isolated from *Artemia*. Lopez-Torres and Lizarrage-Partida (2001) also indicated that analyzed 617 strains from 14 *Artemia*`s commercial brands, *Vibrio spp*. was not detected, but rather a Gram-positive bacterial population capable to grow in the Vibrio-selective media TCBS. Sahul Hameed and Balasubramaniam, (2000) also have isolated Pseudomonas strains from Artemia nauplii. However, the previous studied done by Colorni 1985, shows that the bacterial flora associated with brine shrimp nauplii consisted of V.*alginolyticus, A. proteolytica, A.formicans* and *Pseudomonas* spp. and was thus different from the dominant flora of the larvae. In addition, according to the previous study done by Austin and Allen (1981/1982), found that unhatched cysts, present in hatching tanks develop a heavy bacteria floral.

The previous study from Lopez-Torres and Lizarrage-Partida (2001) shows that the Vibrios introduced with *Artemia nauplii* as a vector came from hatchery operations, not from cysts when the bacterial population changes observed in the comparative study performed under laboratory and hatchery conditions. In Addition, the air supply, hatching water or hatching tanks could be the sources of *Vibrio spp.* According to Sorgeloos *et al*., (1986) Vibrio spp. has become dominant after 24 h, probably because during hatching, Artemia cysts are broken and reserve organic substance, glycerol, is excreted to hatching water. Furthermore, refereeing to Abdelkarim et al., 2009, the results showed that *Pseudomonas spp*. play an importance probiotics in the improvement of the conditions of Artemia culture.

Furthermore, many bacteria settled on the cysts but this could be removed by gentle washing (Austin and Allen, 1981/1982Resistance of marine fish and shrimp pathogenic bacteria to commonly used antibiotics has been reported throughout the world (Lee *et al*., 2009; Sahul Hameed and Balasubramaniam, 2000; Bjroklund *et al*., 1990). The uses of antibiotics have been found to be effective in controlling the bacterial infections of crustaceans (Sahul Hameed and Balasubramanian, 2000). Ocytetracycline, oxolinic,

flumequine, sarafloxacin, furazolidone were the common antibiotics uses for aquaculture (Lee *et al*. 2009; Hektoen *et al*., 1995; Bjroklund et al., 1990). More than 50% of bacteria isolated was sensitive to Spiramycin, Sulphamethoxazole, Novobiocin, Oxolinic Acid, Tetracycline, Doxycycline, Ampicillin Chloramphenicol, Flumequine and Nalidixic Acid.

The bacteria isolated also resistance to heavy metal. This may be due to the water sources of the hatchery that were highly contaminated with antibiotic and heavy metal residue (Lee *et al*., 2009). Changes in salinity will also alter the concentration of inorganic complexion agents, particularly that of chloride. Thus, the concentrations of both free zinc and free cadmium ions increase as salinity decreases (Rainbow, 1995).

ACKNOWLEDGEMENTS

This project was funded by Universiti Malaysia Kelantan and Ministry of Science and Technology (MOSTI) and Fisheries Research Institutes (FRI), Tanjung Demong,Besut,Terengganu .

REFERENCES

[1] Abdelkarim M., Kamel C., Fathi K. and Amina B. 2009. Use of *Pseudomonas stutzeri* and *Candida utilis* in the improvement of the conditions of Artemia culture and protection against pathogens.41; 107-115.

[2] Aguilar-aguila A., Mansir A. T., and Manrquez A. R.1994. Using Brine Shrimp as a Drug Carrier for Therapeutic Applications in Aquaculture.13; 301-309.

[3] Austin B.,Allen D. A.1981/1982.Microbiology of laboratory- hatched brine shrimp (*Artemia*).26;369-383.

[4] Bjorklund H., Bondestam J., and Bylund G., 1990. Residues of oxytetracycline in wild fish and sediments from fish farms.*Aquaculture*. 86; 359-367.

[5] Colorni A. 1985. A study on the bacterial flora of giant prawn, *Macrobrachium rosenbergii*, larvae fed with *Artemia salina* nauplii.49; 1-10.

[6] Cuvin-Aralar.1994.Survival and heavy metal accumulation of two *Oreochromis niloticus* (L.) strains exposed to mixtures of zinc, cadmium and mercury. 148;31-38.

[7] Gatlin D. M. and Wilson R. P. 1986. Dietary copper requirement of fingerling channel catfish. 54; 277-285

[8] Hektoen M., Berge J. A, Hormazabalb V., and Yndesta M. 1995.Persistence of antibacterial agents in marine sediments.133;175-184.

[9] Jayasekara S., Drown D. B. and Sharma R. P.1986. Tolerance to Cadmium and Cadmium-Binding Ligands in Great Salt Lake Brine Shrimp (*Artemia salha*).11; 23-30. 266.

[10] Gatlin D. M. and Phillips H. F. 1989.Dietary Calcium, Phytate and Zinc Interactions in Channel Catfish.59; 259-

[11] Gilmour A., Mc Callum M. F., Allan M. C.1975. Antibiotics sensitivity of bacteria isolated from canned eggs of the Carlifornian brine shrimp (*Artemia salina*).6;221-231.

[12] Gomez-Gil B., Herrera-vega M. A., and Abreugrobois A. 1998. Bioencapsulation of Two Different *Vibrio* Species in Nauplii of the Brine Shrimp (*Artemia franciscana*).2318-2322.

[13] Gomez-gil A., Thompson F. L., Garcia-Gasca A., Roquel A., and Swings J. 2004. *Vibrio hispanicus* sp. nov., isolated from *Artemia sp*. and sea water in Spain.54; 261-265.

[14] Gutknecht J. 1983. Cadmium and thallus ion permeabilities through lipid bilayer membranes.735; 185-188.

[15] Handy R. D. 1993.The effect of acute exposure to dietary Cd and Cu on organ toxicant concentrations in rainbow trout, *Oncorhynchus mykiss*. *Aquatic Toxicology*.27;1-14.

[16] Jun Li, Jun Yie, Foo R. W. T., Ling J. M. L., Xu H. and Norman Y. S. Woo. 1999. Antibiotic Resistance and Plasmid Profiles of Vibrio Isolates from Cultured Silver Sea Bream, *Sparus sarba*.39(1-12);245-249.

Antibacterial Activity of Methanol Extract of *Gracilaria edulis* Against Gram Negative Pathogens

[1]Nor Salmi Bt. Abdullah* and [1]Awang Soh Mamat
Faculty of Agro Industry and Natural Resources, University Malaysia Kelantan, Karung Berkunci 36, Pengkalan Chepa, 16100 Kota Bharu, Kelantan
* norsalmiabdullah@yahoo.com

Abstract
In vivo antibacterial activity of methanol crude extracts of red seaweed, *Gracilaria edulis* was screened against six gram negative human bacterial pathogens. Antibacterial activities of methanol crude extract were examined by well diffusion method and spread methods with *Salmonella typhimurium*, *Citrobacter freundii*, *Pseudomonas aeruginosa*, *Shigella boydii*, *Klebsiella pneumoniae* and *Esherichia coli* Result showed no inhibitory activity against all gram negative bacteria. Thus, gram negative pathogens showed resistant phenotypic pattern to methanol crude extract of *Gracilaria edulis*.

Keywords
Seaweeds, Antibacterial activity, *Gracilaria edulis*, Gram negative, Human pathogen

INTRODUCTION

Seaweeds are the renewable living resources which are also used as food, feed, and fertilizer in many part of world [1, 2]. Seaweeds are a valuable food source as they contain high amount of carbohydrate, protein, lipid, vitamins, amino acid and minerals [1, 3 – 6]. But their nutritional content varies greatly and demonstrates a dependence on such factors as season and environmental growth condition [7, 8].

Antimicrobial study never failed to attract interest among researcher because the use of available antimicrobial drugs has certain limitations due to changing patterns of resistance in pathogen and side effects they produced. These limitations demand for new antimicrobial compounds for the development of drugs. Seaweeds have been screened extensively to isolate life saving drugs and biological activities substances over the world [9, 10]. Several works have been reported on isolation of active compound from seaweed to study antibacterial activity [11 – 16].

Antibacterial properties of Malaysian seaweed were study by [13, 14, 17, 18]. To the best of our knowledge, the biological activity and isolation of active compound from Malaysian seaweed especially *Gracilaria* sp are rare. Many studies on *Gracilaria* sp were based on their taxonomy and habitat characteristics [20, 21]. The present study was undertaken in order to examine the antibacterial effect of crude methanol extract from was washed with tap water to remove epiphyte and *Gracilaria edulis* against six gram negative human pathogen.

MATERIALS AND METHOD

Seaweed

Seaweed was bought from Sungai Petani, Kedah. Sample sand. Seaweed was dried at open air for four days, then milled using electronic grinder into fine powder and kept in airtight bottle and kept in freezer (- 20°C) until using in other experiment.

Preparation of Extract

Dried seaweed was bended into a coarse powder with electric mixer. Powder sample were soaked in methanol in ratio (1:10) for a week. Solvent was removed by rotary evaporator. The resultant crude extract were weight and deep frozen (- 20°C) until tested.

Bacteria Strains Used For Assay

Stock culture of *Shigella bodyii*, *Salmonella typhimurium*, *Pseudomonas aeruginosa*, *Citrobacter freundii*, *Esherichia coli* and *Klebsiella pneumoniae* were provided by Department of Medical Microbiology and Parasitology, University Science Malaysia, Kampus Kesihatan, Kubang Kerian, Kelantan.

Antibacterial Assay

The well diffusion method was followed for antibacterial susceptibility test. The suspensions of bacteria were cultured in nutrient broth for 24 h. The turbidity of the culture was adjusted to an optical density (OD) in range between 0.126 – 0.147. Bacteria was spread using sterilized cotton bud onto the Mueiller Hinton agar. The 6 mm well were made using sterilized yellow tip and were impregnated with 20 µl (0.003 g/ml) of the methanol crude extract for each well. Methanol was used as a negative control while ampicillin antibiotic (0.003 g/ml) was used as a positive control. The plate was incubated at 37°C for 24 h and the inhibition zones measured around the well. Triplicate measurements were carried out for every measurement.

RESULT

The methanol extract at 0.003 g/ml concentration of *Gracilaria edulis* showed no inhibitory activity against all gram negative bacteria. Thus, gram negative pathogens showed resistant phenotypic

pattern to methanol crude extract of *Gracilaria edulis*. The methanol negative control well showed no zone of inhibition against all the test bacterial pathogens. The 0.003 g/ml concentration of ampicillin positive control well showed 13.00 ± 0.00, 7.33 ± 0.33, 2.00 ± 0.00, 8.00 ± 1.00, 0.00 ± 0.00 and 8.33 ± 0.58 for *Salmonella typhimurium, Citrobacter freundii, Pseudomanas aeruginosa, Shigella bodyii* and *Esherichia coli* respectively (Table 1). *Klebsiella pneumoniae* showed resistant to *Gracilaria edulis* as well as ampicillin antibiotic and methanol

Table 1. Antibacterial activity of methanol crude extract against gram negative bacteria.

Bacterial pathogens	*Gracilaria edulis* (mm)	Positive control (mm)	Negative control (mm)
Salmonella typhimurium	NI	13.00 ± 0.00	NI
Citrobacter freundii	NI	7.33 ± 0.33	NI
Pseudomanas aeruginosa	NI	2.00 ± 0.00	NI
Shigella bodyii	NI	8.00 ± 1.00	NI
Klebsiella pneumoniae	NI	0.00 ± 0.00	NI
Esherichia coli	NI	8.33 ± 0.58	NI

NI – (no inhibitory). Each value is presented as mean SD (n = 6). Means within each type of bacteria differ significantly ($p < 0.05$).

DISCUSSION

Antibacterial activity of red, brown and green seaweed against gram positive and gram negative bacteria has been established by several scientists. Among these, red seaweeds were proved to have higher activity than brown and green seaweed [14, 22 – 24]. The antimicrobial activity of seaweed may be influenced by some factors such as the habitat and the season of algal collection, experimental method, etc.

In present study, *Gracilaria edulis* showed no inhibitory against gram negative bacteria. This is an agreement with most survey of antimicrobial, gram negative bacteria strains were low susceptibility to seaweed extract than gram positive bacterial strain [25 – 28]. This different is likely due to the structural differences between the two bacterial types. The cell wall of gram negative bacteria is more complex which decrease susceptibility to antimicrobial substance [29, 30]. In bacteria, the important targets of antimicrobial action are the cell wall, the cytoplasmic membrane, the biosynthetic processes of protein synthesis and nucleic acid synthesis [31]. According to Michael *et al* [32], there were several reasons why certain bacteria may develop resistant to certain antimicrobial agents that may explain the findings of the current study on gram negative bacteria. Absence of the target structure in the bacteria, the ability of the bacteria to alter the structure of the extract to an inactive form and the genetic changes in the bacteria could be some reasons for not inhibiting the bacterial growth.

There is also other possibility that the methanol solvent was not an appropriate solvent for extraction of *Gracilaria edulis*. Studies have showed that antimicrobial properties are substantially affected by solvent selection [33 – 36]. Although the used of organic solvent always provides a higher efficiency in extracting antimicrobial activities as compared to water-extraction [12]. Most common solvent for seaweed extraction are ethanol, chloroform, ethyl acetate, benzene, acetone and diethyl ether [33 – 36]. Kolanjinathan et al [37] used ethanol for extraction of *Gracilaria edulis* and showed an inhibitory against gram positive and gram negative of fish pathogens.

CONCLUSION

The present study revealed that methanol extract of *Gracilaria edulis* showed no inhibitory against gram negative bacteria. This finding doesn't limit the potential used of *Gracilaria edulis*. Ongoing research will further focus on using different type solvents to extract the *Gracilaria edulis* and to study their antibacterial activities against gram positive and gram negative human pathogen.

ACKNOWLEDGMENTS

The study on antibacterial activity of methanol extract of *Gracilaria edulis* against gram negative pathogens was part of PhD work of author. We wish to thank Department of Medical Microbiology & Parasitology, University Science Malaysia for providing the stock culture of bacteria. We are also grateful to the Faculty of Agro Industry and Natural Resources, University Malaysia Kelantan for the research facilities.

REFERENCES

[1] Chapman, V., & Chapman, D. J. (1980). Seaweeds and their uses. London: Chapman and Hall.

[2] McHugh, D. J. (2003). A guide to the seaweed industry. FAO fisheries technical paper 441. Rome: Food and Agricultural Organization of the United Nations.

[3] Norziah, M. H., and Ching, C. Y., (2000). Nutritional composition of edible seaweed *Gracilaria changgi*. Food Chemistry, 68, 69 – 76.

[4] Ruperez, P., (2002). Mineral content of edible marine seaweeds. Food Chemistry, 79, 23 – 26.

[5] Aguilera-Morales, M., Casas-Valdez, M., Carrillo-Dominguez, S., Gonzalez-Acosta, B., Perez-Gil, F., (2005). Chemical composition and microbiological

assay of marine algae Entermorpha spp. as a potential food source. Journal of Food Composition and Analysis, 18, 79 – 88.

[6] Marsham, S., Scott, G. W., and Tobin, M. L., (2007). Comparison of nutritive chemistry of a range of temperate seaweeds. Food Chemistry, 100, 1331-1336.

[7] Dawczynski, C., Schubert, R., Jahreis, G., (2007). Amino acids, fatty acids, and dietary fibre in edible seaweed products. Food Chemistry, 103, 891 – 899.

[8] Ito, K., & Hori, K., (1989). Seaweed: chemical composition and potential uses. Food Review International, 5, 101 – 144.

[9] Jensen, A. (1993). Present and future needs for alga and alga products. Hydrobiology, 260/261, 15 – 21.

[10] Smit, A. J., (2004). Medicinal and pharmaceutical uses of seaweed natural products: A review. Journal of Applied Phycology, 16, 245 – 262.

[11] Simmons, T. L., Andrianasolo, E., McPhail, K., Flatt, P., and Gerwick, W. H., (2005). Marine natural products as anticancer drugs. Molecular Cancer Therapeutics, 4(2), 333 – 342.

[12] Rosell, K. G. and Srivastava, L. M. (1987). Fatty acids as antimicrobial substances in brown algae. *Hydrobiologia* 151/152, 471-475.

[13] Suzuki, M., Daitoh, M., Vairappan, C.S., Abe, T., Masuda, M., (2001). Novel halogenated metabolites from the Malaysian Laurencia pannosa. J. Nat. Prod. 64, 597–602.

[14] Vairappan, C. S., (2003).Potent antibacterial activity of halogenated metabolites from Malaysian red algae, *Laurencia majuscule* (*Rhodomelaceae Ceramiales*). Biomolecular Engineering 20, 255 – 259.

[15] Vairappan, C. S., Suzuki, M., Ishii, T., Okino, T., Abe, T., and Masuda, M. (2008). Antibacterial activity of halogenated sesquiterpenes from Malaysian *Laurencia spp.* Phytochemistry, 69, 2490–2494.

[16] Oh, K. - B., Lee, J. H., Chung, S. – C., Shin, J., Kim, H. – K., Lee, H. – K., (2008). Antimicrobial activities of the bromophenols from the red alga *Odonthalia corymbifera* and some synthetic derivatives. Bioorg. Med. Chem. Lett., 18, 104–108.

[17] Chakraborty, K., Lipton, A. P., Paulraj, R., Chakraborty, R. D., (2010). Guaiane sesquiterpenes from seaweed *Ulva fasciata Delile* and their antibacterial properties. European Journal of Medicinal Chemistry, 45, 2237–2244.

[18] Wong, W. H., Goh, S. H., & Phang, S. M., (1994). Antibacterial properties of Malaysian seaweeds. Algae Biotechnology in the Asia-Pasific-Region, Phang *et al*., (Ed.) University of Malaya. pp: 75-81.

[19] Vairappan, C.S., Phang, M., (2005). Morphology and halochamigrene metabolites in Spratly Island species of *Laurencia majuscula* (*Rhodomelaceae, Ceramiales*). Malaysian J. Sci., 24:21–27.

[20] Santelic, B., & Doty, M. S., (1989). A review of *Gracilarie* family. *Aquaculture*, 78, 95 – 133.

[21] Critchley, A. T. (1993). *Gracilaria* (*Rhodophyta*, *Gracilariales*): an economically important agrophyte. In A. T. Critchley, & M. Ohno, *Seaweed cultivation and marine raching* (1st ed., pp 89-112). Japan International Cooperation Agency (JICA).

[22] Vallinayagam, K., Arumugam, R., Ragupathi Raja Kannan, R., Thirumaran, G., & Anantharaman, P., (2009). Antibacterial activity of some selected seaweeds from Pudumadam Coastal Regions. Global Journal of Pharmacology, 3(1), 50 – 52.

[23] Roa, P., Parekh, K.S., (1981). Antibacterial activity of Indian seaweeds. Phykos, 23, 216 – 221.

[24] Pandakumar &, Ayyakkannu, K., (1997). Seasonal variation of antibacterial and antifungal activities of the extract of marine algae from Southern coasts of India. Botanica Marina, 40, 507 – 515.

[25] Sreenivasa, R. P., and Parekh, K. S., (1981). Antibacterial activity of Indian seaweed extract. Bot. Mar. 24, 577 – 582.

[26] Pesando, D., & Caram, B (1984). Screening of marine algae from the French Mediterranean coast for antibacterial and antifungal activity. Bot. Mar. 27, 381 – 386.

[27] Ballantine, D. L., Gerwick, W. H., Velez, S. M., Alexander, E., & Guevara, P., (1987). Antibiotic activity of lipid-soluble extract from Caribbean marine algae. Hydrobiologia 151/152, 463 – 469.

[28] del Val, A. G., Platas, G., Basillio, A., Cabello, A., Gorrochategui, J., Suay, I., Vicente, F., Pelaez, F., Portillo, E., del Rio, M. J., & Reina, G. G., (2001). Screening of antimicrobial activities in red, green and brown macroalgae from Gran Canaria (Canary Islands, Spain). Int. Microbiol, 4, 35 – 40.

[29] Reichelt, J. L., & Borowitzka, M. A. (1984). Antimicrobial activity from marine algae: results of a large-scale screening program. Hydrobiologia, 116/117, 158 – 167.

[30] Freile-Pelegrin, Y., & Morales, J. L., (2004). Antibacterial activity in marine algae from the coast of Yucatan, Mexico. Botanica Marina, 47, 140 – 146.

[31] Al-Haj, N. A., Mashan, N. I., Shamsudin, M. N., Mohamad, H., Vairappan, C. S., & Sekawi, Z. (2009). Antibacterial activity in marine algae *Eucheuma denticulatum* against *Staphylococcus aureus* and *Strepttococcus pyogenes*. Research Journal of Biological Science, 4(4), 519-524.

[32] Micheal, T. M., John, M. M., & Jack, P., (2002). Brock Microbiology of Microorganism. 10th Edn. New Jerse. ISBN: 10-0130662712.

[33] Parekh, K. S., Parekh, H. H., Roa, P. S., (1984). Antibecterial activity of Indian seaweeds. Phykos, 23, 216 – 221.

[34] Sastry, V. M. V. S., & Roa, G. R. K., (1994). Antibacterial substances from marine algae: Successive extraction using benzene, chloroform and methanol. Botanica Marina, 37, 375 – 377.

[35] Febles, C. I., Arias, A., Gil-Rodriguez, M. C., Hardisson, A., Sierra Lopez, A., (1995). In vitro study of antimicrobial activity in algae (Chlorophyta, Phaeophyta and Rhodophyta) collected from the coast of Tenerife (in Spainish). Anuario del Instituto de Estudios Canarios, 34, 181 – 192.

[36] Cox, S., Abu-Ghannam, N., & Gupta, S., (2010). An assessment of the antioxidant and antimicrobial activity of six species of edible Irish seaweeds.

[37] Kolanjinathan, K., Ganesh, P., & Govindarajan, M., (2009). Antibacterial activity of ethanol extract of seaweed against fish bacterial pathogens. European Review for Medical and Pharmacological Sciences, 13, 173 – 177.

Good Manufacturing Practices, Microbial and Quality of Kelantan Local Budu

Wan Anis Binti Wan Ahmad[1,*], Awang Soh Bin Mamat[2]
Universiti Malaysia Kelantan
Locked Bag 36, Pengkalan Chepa
16100 Kota Bharu, Kelantan
Malaysia
*triptofana82@yahoo.com

Abstract

Budu is a fish sauce product formulated from mixture of fish and salt that has been fermented between six to twelve month at 30°C – 35°C in a covered container. The product then filtered, heat-treated, added with sugar, monosodium glutamate, permitted flavouring and been bottled. The samples obtained from 5 difference budu producers were analysed to evaluate and asses the good manufacturing practices (GMP), protein, salt, total nitrogen content, moisture, pH and total plate count. The GMP result indicated that two of budu processing factories had been classified as good and the rest three factories are classified as medium, poor and very poor, respectively. The quality of budu is rated by total nitrogen content where total nitrogen above 2.0% was classified as grade 1. Total nitrogen content of Kelantan Local Budu result showed ranging between 1.78% - 1.18%. Total plate counts observation showed that bacteria count colony in budu samples were corresponding with the GMP of processing factory result.

Keywords

Budu, fish sauce, GMP, total nitrogen content, total plate count

INTRODUCTION

Budu is a brown to dark brown condiment that produces and consumed mainly by people in East Cost state of Malaysia namely Kelantan and Terengganu. Budu is generally made from small pelagic species such as anchovies and sardines [1, 2] by mixing with coarse salt in the ratio of 3:1 [3]. The major application of budu is as condiment on rice dishes, but in addition to of amino acids for some social classes and in specific areas in the region [3]. Lafont (1955) [4] reported that Patis (Philippine fish sauce) and other fish sauces should not be considered as condiments only. According to Sanceda et al. 1994 [3], fish sauces contain about 20 g/liter of nitrogen, of which 16 g/liter are in the form of amino acids, those with 1% nitrogen or more could be considered as rather better than condiments and they may be significant as sources of protein for human nutrition.

According to Rosma et al. (2009) [5] study, unprocessed budu[1] sample from Kelantan and Terengganu are free from *E. coli, Coliform, V. parahaemolyticus* and *V. cholerae* contamination. These occurred due to fermentation provides a highly ionic environment to preserving food and inhibiting the growth of pathogenic bacteria. However, for the nutritional quality and safety of fermented food should therefore be viewed within the context of the complete food processing operation [6]. Budu is presently prepared by traditional processes and usually unhygienic methods, paving the way for possible microbial contamination [7]. To manage the contamination of pathogenic bacteria in budu, application of good manufacturing practices (GMP) should be implementing in budu fermentation processing. Good manufacturing practice is a sanitary processing requirement procedure that applicable to all food processing establishments for ensuring the manufacturing quality and food safety. GMP describes the methods, equipment, facilities and control for producing processed foods. The GMP consist of five subparts, the requirements are purposely general to allow individual variation by manufacturers to implement the requirements in a manner that best suit their needs [8].

The aim of this research is to evaluate the good manufacturing practices (GMP) among Kelantan budu processing factories and also published data to our knowledge on chemical composition, nutritional quality and safety of popular budu that available in market. Besides that, we also incorporated to advancement our local heritage dish.

[1]The term unprocessed budu refer to the mixture of fish and salt that allowed to ferment in certain period of time and had not been heat-treated nor formulated by additional ingredient.

MATERIAL & METHODS

Field survey and Sampling

The GMP studies required intensive field survey among selected budu producers. This survey was conducted from February 2010 to April 2010, involving 5 budu processing plant in Kelantan. The survey area was at Tumpat and Bachok which is the factory was registered under Kelantan Department of Fishery (DOF) and Fisheries Development Authority (LKIM).

A local budu sample was collected from 5 budu producers in Kelantan, Malaysia. A duplicate 1 liter sample was collected from each producer in a blue screw cap schott duran glass bottles. All the samples were collected on single day and transport back to lab at ambient temperature. The samples were kept frozen (-19) until needed for analysis to stop further fermentation [5].

GMP Evaluation

Assessment was carried out by applying a Food GMP Inspection (FORM FDA 2966) to the budu processing plant and ranking them as excellent, good, medium, poor or very poor. The questions in the form are designed to obtain information about processing plant and ground, equipment and utensils, sanitary facilities and controls, sanitary operation, processes and control and personnel.

The form consisted of the six parts: Part one, plants and grounds, was evaluated by 9 questions (K = 10); part two, equipment and utensils, by 3 questions (K = 15); part three, sanitary facilities and controls, by 7 questions (K = 25); part four, sanitary operations, by 9 questions (K = 20); part five, processes and controls, by 11 questions (K = 30) and part six, personnel, by 4 questions. The score of each part evaluated (P) was calculated using the formula below, where TS represents the total of points obtained; □1 represents the total number of possible points; □2, represents the total number of points ‘‘not applicable”; and K is a, constant (□K = 100).

$$P = (TS / (□1-□2)) \times K$$

The mean of the scores of the six parts was calculated (P1 + P2 + P3 + P4 + P5 + P6/10) and the processing plant was classified according to a scale: Excellent: 9.1–10; good: 7.0–9.0; medium: 5.0–6.9; poor: 2.0–4.9; and very poor: 0–1.9 [9].

ANALYSIS

pH and Moisture Content

The pH of local budu was determined directly using a digital pH meter. Moisture content (g/100 g) was determined by weight difference after heating the sample at 103 ± 2 ^{o}C for 4 h[10].

Sodium chloride (salt)

Sodium chloride content in a sample was measured by the Mohr method.1 ml sample was pipetted into 49 ml of boiling distilled water and stir vigorously for 2 min. The solution then allowed cooling using running water. Then transfer 20 ml of each solution to Erlenmeyer flask and 1 ml of potassium chromate indicator were added. The solution was titrated with standardised 0.1 M $AgNO_3$ to the first visible pale red-brown colour that persists for 30s.The titrated volume was recorded and percentage of sodium chloride were calculated [11].

Total Nitrogen Content and Protein

Total nitrogen content of Budu was determined by the Kjeldahl method (AOAC 2001.11) using Tecator Kjeltec System. Crude protein was estimated by multiplying total N by 6.25.

Microbiological Analysis

Microorganisms in budu are important for the quality fish sauce. An aliquot of the budu were taken aseptically from budu bottles for microbial count. Total viable counts were determined by spread plate method using Plate Count Agar containing 0.5% NaCI as the medium. Plates will incubate at 30^{o}C for 48 h [12]. Number of colonies counted on each plate and microbiological data were transformed into logarithms of the number of colony forming units (cfu/g).

RESULT AND DISCUSSION

Five budu processing factories were evaluated by Food GMP Inspection Form. The data indicates that in the evaluation of the plant and grounds CW, CP, CSS factories demonstrated score 0.55 and CK and CNB score was 2.77 and 3.33, respectively. The main problem identified were insufficient space to placement of equipment, material and production operation. The floor, walls and ceiling also not from cleanable materials. Air quality and ventilation inadequate to prevent contamination by dust or airborne substance.

Table 1. GMP evaluation of budu processing factory in Kelantan

Budu Factory	CK	CW	CP	CSS	CNB
Part 1 (K=5)	2.77	0.55	0.55	0.55	3.33
Part 2 (K=25)	25.00	25.00	0.00	0.00	25.00
Part 3 (K=10)	5.71	6.67	2.86	5.71	5.71
Part 4 (K=15)	10.00	11.67	2.14	6.42	13.33
Part 5 (K=25)	15.00	15.00	2.27	10.00	20.00
Part 6 (K=20)	15.00	10.00	10.00	10.00	10.00
Total score	7.35	6.89	1.78	3.27	7.74
Classification	Good	Medium	Very poor	Poor	Good

Part 1 = plants and grounds
Part 2 = equipment and utensils
Part 3 = sanitary facilities and controls
Part 4 = sanitary operation
Part 5 = process and controls
Part 6 = personnel

In the evaluation of the equipment and utensils, score for CP and CSS factory was zero however, full score for CK, CW, CNB. All utensils and equipment in factory CP and CSS not constructed of adequate cleanable materials for intended uses.

In the evaluation of the sanitary facilities, all the factory had score 5.00 above except CP factory had score 2.86. The problem for CP factory was all refuse not properly stored and protected where necessary from insects, rodent and other pest. From the survey, all the factories not provided toilet rooms for their staff.

In the evaluation of the sanitary operation, CP and CSS factory score was 2.14 and 6.42, respectively. CK, CW and CNB had better score which is 10.00, 11.67 and 13.33, respectively. For the evaluation of process and controls, CNB factory had the highest score 20.00 and CP factory had the lowest score 2.27. In general the main problem identified was the poor maintenance of sanitary operation and process. Personnel evaluation score for CW, CP, CSS and CNB factories were 10.00, meanwhile CK factory score was 15.00. Employees for all factories observe good food handling techniques in processing are but no outer garment and gloves provided to employee except CK factory.

Table 2. Value of the pH, moisture content and salt content in Kelantan local budu

Local Budu	pH	Moisture content (%)	Salt Content (%)
CK	4.88	56.08	26.64
CW	5.23	44.69	26.03
CP	5.39	53.72	20.70
CSS	5.41	64.69	27.33
CNB	5.35	35.71	27.63

Values of pH, moisture content and salt content in Kelantan local budu are presented in Table 2. The levels of pH and moisture content in all samples range from 4.88 to 5.41 and 35.71% to 64.69%, respectively. The salt content of Kelantan local budu ranged between 20.70 % to 27.63 % (w/v) with a mean value of 25.67% (w/v). As a result of this high salt content, a highly ionic environment created in budu which is the metabolic activities in pathogenic cells could not function. The high salt concentration also retards or kill the pathogenic microbes during fermentation [13]. The Malaysian Food Act 1983 and Regulation 1985 have stated that salt in budu must not be lower than 15%. A lower salt content may allow the growth of spoilage microorganisms (*Aspergillus chevalieri*, *Escherichia* sp., *Serratia* sp., *Pseudomonas* sp. and *Clostridium* sp.) and maggots that produce putrid odor and lower the fish quality [14, 13].

One of the most important quality factors for fish sauce in the total nitrogen content in the liquid and regulatory standards for quality have been based on this value. It is the only objective index used to classify the quality of the Thai fish sauce nampla [15]. The total nitrogen content of the sample was between 1.19% to 1.78%. The high quality nampla and patis must have 1.5% or higher total nitrogen content, based on the Kjeldahl method [15,13,16]. According to the result, two samples were not classified as high quality budu. The highest value of total nitrogen content in sample below are 1.78 %. Beddows et al. (1979) [17] found 1,77% total nitrogen in budu after 154 days of fermentation during a commercial production of the fish sauce.

Table 3 also showed the protein content of sample was between 7.47% to 11.15%. According to Malaysian Food Act 1983 and Food Regulations 1985, fish sauce or 'budu' shall contain not less than 5% protein. The protein content in all sample were fulfill the Malaysian Food Regulation 1985 requirement. However, a good grade fish sauce shall contain not less than 12.5% protein [2].

Table 3. Value of the total nitrogen content (TNC) and protein in Kelantan local budu

Sample	TNC (%)	Protein (%)
CK	1.63	10.16
CW	1.78	11.15
CP	1.19	7.47
CSS	1.42	8.86
CNB	1.58	9.88

Total viable counts (Table 4) showed that in CNB sample, no bacteria colony was detected. Sample CP presented highest count bacteria which is 1.63 x 10^4 cfu/g. The total bacteria colony count pattern was corresponding with the GMP result. This show, implementing GMP to the processing plants were reduces the microbial contamination to the food product. Budu itself are free from pathogenic bacteria however, cross contamination that occur during processing is the major leading factor to food contamination.

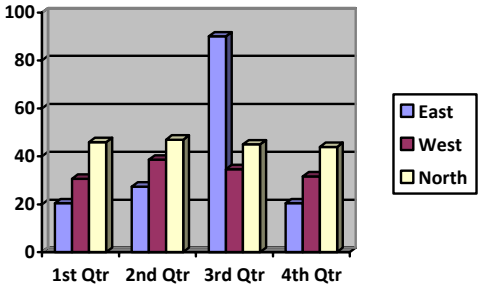


Table 4. Total bacteria colony count, incubate at 30°C in 48 h

Sample[a]	cfu/g
CK	1.0×10^2
CW	2.5×10^3
CP	1.63×10^4
CSS	5.6×10^3
CNB	ND[b]

[a] Dilution factor for all sample are 10^{-1} and amount of spread sample are 0.1 ml

[b] ND, not detected

CONCLUSIONS

In general the GMP evaluation obtained by visual inspection (questionnaire) showed that Kelantan budu processing plant needs high improvement for the high quality production. Lack of knowledge and awareness among food handlers causes fermentation technology still at low level in Kelantan. The pH, moisture content and salt had no correlation with GMP. No detected viable bacteria count for the CNB factory which is had highest score for GMP evaluation. Whereas the total nitrogen content not only depends on GMP but also depends on the raw material. The quality of budu was corresponding with the GMP level.

ACKNOWLEDGMENTS

The authors are grateful to the Faculty Agro Industry and Natural Resourses for the project and to the Universiti Malaysia Kelantan for the Short Term Grant (R/SGJP/A03.00/00278A/001/2009/000016) for funding this research.

REFERENCES

[1] Amano, K. (1962). Influence of fermentation of the nutritive value on fish with special reference to fermented fish products of Southeast Asia. In E. Heen & R. Kreuzer (Eds.), Fish in nutrition, 180–200. London: Fishing News.

[2] Saisithi, P. (1994). Traditional fermented fish: fish sauce production. In A. M. Martin (Ed.), Fisheries processing biotechnology application, 111–131. London: Chapman and Hall.

[3] Sanceda G. N., Sanceda F. M., Encanto S. Velma., Kurata T., Arakawaa N., (1994). Sensory evaluation of fish sauces. Food Quality and Prefeances, 5 (3), 179 – 184

[4] Lafont, R. (1955). Valeur alimentaire des sauces de poisson. In Proceeding of Indo-Pacific Fish Council, 15th Meeting, Bangkok, Thailand, Sections 11 and 111, p. 163.

[5] Rosma, A., Afiza, T. S., Wan Nadiah, W. A., Liong, M. T. and Gulam, R. R. A. (2009). Short Communication Microbiological, histamine and 3-MCPD contents of Malaysian unprocessed budu. International Food Research Journal, 16, 589 - 594.

[6] Motarjemi Y. (2002). Impact of small scale fermentation technology on food safety in developing countries. International Journal of Food Microbiology, 75, 213 – 229.

[7] Anihouvi, V.B., Ayernor, G.S., Hounhouigan, J.D. and Dawson, E.S. 2006. Quality characteristics of lanhouin: traditionally processed fermented fish product in the republic of Benin, African Journal of Food, Agriculture, Nutrition and Development 6 (1).

[8] FDA, Good Manufacturing Practices for 21st Century – Food Processing, 9 August 2004.

[9] Santana N. G., Almeida C.C. R., Ferreira J. S., Almeida F. P. (2009). Microbiological quality and safety of meals served to children and adoption of good manufacturing practices in public school catering in Brazil. Food Control 20, 255–261.

[10] ISO (1983). 6496 – Determination of moisture and other volatile matter content.. Geneva, Switzerland: The International Organization for Standardization, pp. 1–7.

[11] S. Suzanne Nielson. 2003. Sodium Determination Using Ion Selective Electrodes, Mohr Titration and Test Strips. Food Analysis Laboratory Manual. Plenum Publishers, New York. page 57-66.

[12] Harriganm, W. F., & Mccanee, M. E. (1976). Laboratory methods in food and dairy microbiology. London: Academic press.

[13] Lopetcharat, K., Choi, Y. J., Park, J. W., & Daeschel, M. D. (2001). Fish sauce products and manufacturing – a review. Food Reviews International, 17(1), 65–88.

[14] Sidaway, E.P. and Balasingam, M. 1971. Fish processing industry in west Malaysia Technical study of Malaysian Food Technology Research and Development Centre, Kuala Lumpur.

[15] Wilaipan, P. (1990). Halophylic bacteria producing lipase in fish sauce. [M.Sc. thesis]. Bangkok, Thailand: Chulalongkorn University.

[16] Lopetcharat, K., & Park, J. W. (2002). Characterization of fish sauce made from Pacific whiting and surimi by-products during fermentation stage. Journal of Food Science, 67(2), 511–516.

[17] Beddows, C. G., Ardeshir, A. G., & Daud, W. J. (1979). Biochemical changes occurring during the manufacture of Budu. Journal of the Science of Food and Agriculture, 30, 1097–1103.

Occurrence of Heavy Metals and Antibiotic Resistance in Bacteria Isolated from Smoked Etak, *Corbicula fluminea* in Kelantan

Zalina C. M*., Daniel G., and Lee S. W.
Department of Agro Industry, Faculty of Agro Industry and Natural Resources,
Universiti Malaysia Kelantan.
*zalinacm86@gmail.com

Abstract
A total of 10 bacteria have been successfully isolated from Etak in Tumpat, Kelantan, namely, Salmonella spp. (n=5) and Edwardsiella spp. (n=5). The isolates were tested against 19 antibiotics resulting in 114 (60.0%) cases of sensitive, while 13 (6.8%) and 63 (33.2%) cases of intermediary sensitive and resistant respectively. The result of multiple antibiotic resistance (MAR) index of the bacteria isolates was 0.37 and 0.26 for Salmonella spp. and Edwardsiella spp. respectively, which indicated that the bacteria isolated from Etak have been exposed to tested antibiotics. Furthermore, all the isolates were resistant to tested heavy metals, namely, mercury (Hg^{2+}), zinc (Zn^{2+}) chromium (Cr^{6+}), and copper (Cu^{2+}). Up to date, no database information on heavy metal or antibiotic resistance on Etak (Corbicula fluminea). Thus, the current results provided us information on antibiotic and heavy metal level in Etak in Kelantan.

Keywords
Salmonella spp., *Edwardsiella* spp. Etak, MAR, heavy metal

INTRODUCTION

Shellfish including Asian clam, *Corbicula fluminea* known as "Etak" in Kelantan dialect, is a filter feeder, which is one of the most popular foods for Kelantan people. River pollution and preparation process of smoked Etak are two major factors contribute to bacterial contamination which is suspected the cause of typhoid or salmonellosis disease among consumers. Up to date, no database information on antibiogram and heavy metal resistance profile of bacteria from Etak in Malaysia. Thus, this study was carried out to evaluate the antibiotic and heavy metal tolerance of the bacteria obtained from smoked Etak in Kelantan.

MATERIALS AND METHODS

Etak (*C. fluminea*) samples were collected from Tumapt River, Kelantan, Malaysia. 5 pieces of selected Etak with the weight ranged from 5 to 10 g were diluted in 25 ml of saline water in centrifuge tube. The tubes were vortexed vigorously and 100 µL of sample were plated on selected medium; Xylose Lysine Deoxycholate (XLD) agar (Oxoid, England). Plates were incubated at room temperature (28-30^{o}C) for 24-48 h. Colonies were then selected and kept in Tryptic Soy Agar (TSA) for further studies.

The present isolates were cultured in Tryptic Soy Broth (TSB) (Oxoid, England) for 24 h at room temperature. Antibiotic susceptibility test was carried out according to Kirby-Bauer disk diffusion method using Mueller-Hilton Agar [3]. Antibiotic tested included oxolinic acid (2 µg), ampicillin (10 µg), erythromycin (15 µg), lincomycin (15 µg), oleandomycin (15 µg), amoxicillin (25 µg), colistin sulphate (25 µg), sulfamethoxazole (25 µg), chloramphenicol (30 µg), doxycycline (30 µg), florfenicol (30 µg), flumequine (30 µg), kanamycin (30 µg), nalidixic acid (30 µg), novobiocin (30 µg), tetracycline (30 µg), fosfomycin (50 µg), spiramycin (100 µg), and compound sulphonamides (300 µg). (Oxoid, England). Interpretation of the results, namely sensitive (S), intermediary sensitive (I), and resistance (R), was made in accordance to the standard measurement of inhibitory zones in millimeter (mm). Finally, the antimicrobial susceptibility of the isolates present was determined according to National Committee for Clinical Laboratory Standards [1].

Multiple antibiotic resistances (MAR) index of the present isolates against the tested antibiotics was calculated based on the formula as follows [12]:
MAR index = X / (Y x Z)
X = Total of antibiotic resistance case;
Y = Total of antibiotics used in the study;
Z = Total of isolates.

A MAR index value of equal or less than 0.2 was defined as those antibiotics were seldom or never used for the animal in terms of treatment whereas the MAR index value higher than 0.2 is considered that animal have received high-risk exposure to those antibiotics.

Heavy metal resistance test was carried out as described by [9]. Bacterial tolerance to four elements of heavy metal, i.e., mercury (Hg^{2+}), zinc (Zn^{2+}) chromium (Cr^{6+}), and copper (Cu^{2+}), was determined by agar dilution method. Overnight bacterial suspension was spread onto the plates of TSA medium and incorporated with different concentrations of $HgCl_2$, $ZnCl_2$, $K_2Cr_2O_7$, and $CuSO_4$ (Fluka, Spain). By two-fold dilutions, concentration of both Zn^{2+} and Cr^{6+} was ranging from 25 to 400 µg mL^{-1} while concentration of $Hg2^{+}$ and Cu^{2+} was ranging from 2.5

to 40 µg mL^{-1} and 150 to 2400 µg mL^{-1}, respectively. The isolates were considered resistant if growth was obtained at concentration of 100 µg mL^{-1} (Zn^{2+} and Cr^{6+}) and 600 µg mL^{-1} (Cu^{2+}) [2, 6, 8] after 48 h incubation at room temperature.

RESULT

In the present study, a total of 10 bacterial isolates were successfully isolated comprising *Salmonella* spp. (n=5) and *Edwardsiella* spp. (n=5). A total of 63 cases (33.2%) were reported as resistant, whereas 114 (60.0%) and 13 (6.8%) were respectively sensitive and intermediately sensitive (see Figure 1). All bacterial isolates were sensitive to oxolinic acid, florfenicol, nalidixic acid and chloramphenicol against *Salmonella* spp. and ampicillin, oleandomycin, and flumequine against *Edwardsiella* spp. (see Table 1). On the other hand, all the bacterial isolates were found to be resistant against lincomycin and sulphamethoxazole. The MAR values in the present study for *Salmonella* spp. and *Edwardsiella* spp. was 0.37 and 0.26 respectively (see Table 2). All the bacterial isolates in the present study were resistant to all the tested heavy metal.

Table 1. Percentage of sensitivity of *Salmonella* spp. *and Edwardsiella* spp. in Etak against 19 antibiotics

Antibiotic (µg/disk)	Sensitive (%)	
	Salmonella spp.	*Edwardsiella* spp.
Oxolinic acid (2)	100	100
Ampicillin (10)	60	100
Erythromycin (15)	0	80
Lincomycin (15)	0	0
Oleandomycin (15)	0	100
Amoxicillin (25)	80	80
Colistin sulphate (25)	0	80
Sulphamethoxazole (25)	0	0
Chloramphenicol (30)	100	80
Doxycycline (30)	80	80
Florfenicol (30)	100	100
Flumequine (30)	80	100
Kanamycin (30)	60	80
Nalidixic acid (30)	100	100
Novobiocin (30)	20	0
Tetracyclin (30)	80	80
Fosfomycin (50)	80	40
Spiramycin (100)	0	60
Sulphoamide compound (300)	60	20

Table 2. Multiple antibiotic resistance (MAR) index of *Salmonella* spp. *and Edwardsiella* spp. in Etak

Bacterial isolate	MAR index
Salmonella spp.	0.37
Edwardsiella spp.	0.26

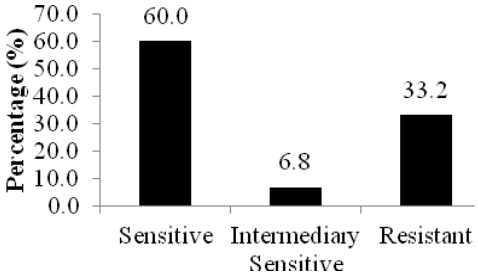


Figure 1. Total percentage (%) sensitivity of 19 antibiotics against *Salmonella* spp. and *Edwardsiella* spp. isolated from Etak

DISCUSSION

In the current study, oxolinic acid, florfenicol, and nalidixic acid were found effective of being used as antimicrobial agents to control *Salmonella* spp. *and Edwardsiella* spp. isolated from Etak since 100% of the bacterial isolates were sensitive to these antibiotics. However, the Malaysian government has banned the use of chloramphenicol, oxolinic acid, nitrofurantoin, and tetracycline in Malaysian aquacultures [10]. Therefore, chloramphenicol, ampicilin, oleandomycin, and flumequine can be suggested as antimicrobial agents in the treatment of disease due to *Salmonella* spp. and *Edwardsiella* spp.

The bacteria isolates of this study were resistant to most of the tested antibiotics and heavy metals. This may due to the water environment of the Etak that were highly contaminated with antibiotic and heavy metal residues. This was supported by the MAR index obtained in this study which showed that the Etak were highly exposed to tested antibiotics. Previous study reported that the MAR index of bacteria from giant freshwater prawn hatchery with 0.67 was may be from nearby industrial sewage or agricultural activity [8]. Therefore, the result in present study provided an early warning on antibiotic resistance in bacteria isolated from Etak.

Effluent from the sewage plant passes into a coastal river where edible shellfish (mussels, oysters) live [5]. Shellfish concentrate bacteria as they filter several liters of water per hour. Ingestion by humans of these seafoods (uncooked or superficially cooked) may cause typhoid or other salmonellosis. [4, 7]

Noticeably, all the isolates were resistant to the tested heavy metals; mercury, chromium, copper, and zinc. Based on data of the Department of Environment,

Malaysia reported that majority of all stations in Kelantan are still being polluted by suspended solids and fecal coliforms bacteria [11]. Thus, present study suggested that water environment of the Etak may contain certain level of antibiotic and heavy metals lead to the development of resistance in the inhabiting bacteria of Etak. Hence, smoked Etak is unsafe for consumption since it is semi-cooked food. The presence of the *Salmonella* spp. and *Edwardsiella* spp. in smoked Etak indicated possible contaminations to the food source. The present findings suggest that the person involved in Etak production should practice a proper and hygiene management either at collection centers or preparation process in order to keep the quality of Etak as well as to avoid high growth of pathogens such as *Salmonella* spp. and *Edwardsiella* spp. which are hazardous to human.

ACKNOWLEDGMENTS

This study was supported by Universiti Malaysia Kelantan Short Term Grant R/SGJP/A0.300/ 00463A/001/2010/000028

REFERENCES

[1] Anonymous. 2006. Clinical and laboratory standards institute (CLSI): Performance standards for antimicrobial susceptibility testing; sixteenth information supplement, M100-S16. CLSI, Wayne, USA

[2] Allen, D. A., Austin, B., Colwell, R. R. 1977. Antibiotic resistance patterns of metal tolerant bacteria isolated from an estuary. Antimicrob. Agents Chemother. 12: 545-547.

[3] Bauer, A. W., Kirby, W. M. M., Sherris, J. C., and Turck, M. 1966. Antibiotic susceptibility testing by a standardized single disk method. Am. J. Pathol. 45: 493-496.

[4] Burkhardt, W., Watkins, W. D., Rippey, S. R. 1992. Seasonal effects on accumulation of microbial indicator organisms by *Mercenaria mercenaria*. *Appl Environ Microbiology*, 58:826 831.

[5] Ekanem, E. O., and Adegoke, G. O. 1995. Bacteriological study of West African clam (*Egeria radiate* Lamarch) and their overlaying waters. J. Food Microbiol. 12: 381-385.

[6] Feng, P., Weagent, S. D., and Grant, M. A. 2002. Bacteriological Analytical Manual Online.www.lib.ncsu.edu/pubweb/www/ETDdb/ web_root/collection/available/etd-04102005-213953/unrestricted/etd.pdf.

[7] Kenneth, T. 2010. *Salmonella* and Salmonellosis. The Microbial World Lectures in Microbiology by University of Wisconsin-Madison *Department of Bacteriology*

[8] Lee, S. W., Najiah, M., Wendy W., Zahrol, A., and Nadirah, M. 2009. Multiple antibiotic resistance and heavy metal resistance profile of bacteria isolated from giant freshwater prawn (*Macrobrachium rosenbergii*) hatchery. *Agricultural Science in China*, 6: 740-745.

[9] Miranda, C. D., and Catillo, G. 1998. Resistance to antibiotic and heavy metals of motile aeromonads from Chilean freshwater. Sci. Total Environ. 224: 167-176.

[10] Najiah, M., Lee, S. W., Wendy, W., Tee, L. W., Nadirah, M., and Faizah, S. H. 2009. Antibiotic resistance and heavy metals tolerance in gram-negative bacteria from diseased American bullfrog (*Rana catesbeiana*) cultured in Malaysia. *Agricultural Science in China*, 10: 1270-1275.

[11] Ruhil, H. H., Najiah, M., Nadirah, M., Lee, S. W., and Aliuddin, S. 2008. Isolation oand enumeration of coliform bacteria and *Salmonella* spp. from short necked clam *Orbicularia orbiculata* at East Coast, Malaysia. *Food Safety Information Publishing*, 10: 58-64.

[12] Sarter, S., Nguyen, H. N. K., Hung, L. T., Lazard, J., and Montet, D. 2007. Antibiotic resistance in Gram-negative bacteria isolated from farmed catfish. *Food Control* 18: 1391-1396.

A Smart Energy Detective System for Monitoring and Controlling Time of Use Pricing in Real Time Power Consumption

[1] Azhar Fakharuddin. Ahmad N. Abdalla. Muhammad Rauf. Iftikhar Abid
Faculty of Electrical and Electronic Engineering, University Malaysia Pahang. Pekan.26300.
[1] Corresponding author: engineer103@hotmail.com

Abstract
The embedded system is basically dedicated to specific tasks to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale. Remarkable progress achieved by these systems also motivated professionals to design power monitoring solutions, a latest of which is back bone of smart grid termed as Smart Meter. The designed algorithm offered here consists of different sensors and devices controlled by a high-tech chip as brain of a system. This brain is responsible to monitor and display all defined parameters and also eligible to highlight any problem happening in running system. This design is having ability to be very effective in term of electrical peak load management and a cost effective solution for different categories of users.

Key Words
Real time embedded system, Digital power monitoring, Electric Peak management, GSM-SMS technology.

INTRODUCTION

In traditional monitoring, human labor i.e. a line man plays a significant role in collecting and managing field data. However, due to the size increase of consumption areas, this kind of manual practice is considered time consuming and labor intensive. As the Malaysia economy sector is recovering from the financial and economic crisis, resurgence in energy demand is expected. Within the last three years, the energy generating capacity (increases according to the energy demand) has increased almost 20%, from 13,000 MW in the year 2000 to 15,500 MW in the year 2003. The energy generating capacity is further expected to increase to 22,000 MW by the year 2010 [1].

In order to meet the increasing demand, energy supply infrastructure will needed to be continuously develop and at the same time being very capital intensive. Consequently, this will impose tremendous pressure on the natural resources, particularly for developing countries like Malaysia. At the same time, it is clear that the current patterns of growth, resource use and environmental degradation cannot extend indefinitely into the future [2].

One more important issue in Malaysian electric system is regarding to the peak power consumption which need to be seriously addressed. Till now, there is lacking of a clear way out from this growing challenge. An overview of local energy statistics shows that the major contribution of electricity generation is from thermal plants mainly depending on imported coal. This year the price for import of coal will be near to 1000M $ which is 3 times greater than 2006 that was 316M $. Results from the study shows that CO2 emission from coal fired power plants will grow at 4.1% per year to reach 98 million tons in Malaysia.[3].

One of the main solutions of getting out this peak problem is to provide the user actual consumption monitoring in real time. Main focus of this paper is on developing a new intelligent power monitoring system. The package of designed embedded system consists of the advanced control technique comprising of two parts; slave part which is controlled by high-tech controller and Master part which is actually being dedicated to handle a particular task, which may require very powerful processors having some element of extensibility or programmability. In this work we will consider, more specifically, real-time embedded systems used in a communication intensive environment, which have some peculiarities that may be considered when we are developing new applications. For real-time constraints we mean that a real-time system must satisfy explicit (bounded) response-time constraints or its correctness may be compromised, risking severe consequences, including failure.. In these systems, the response time is as important as the correctness of the outputs. A real-time system does not have necessarily to be fast; it must simply produce correct responses within a definite time limit. A real-time embedded system usually monitors on the environment where the embedded system is installed, and if it does not respond in time to a request, the result can be disastrous. [5]. Slave part, mounted on the User location, containing 32bit MCU [6] integrating sensing devices, UN limited range GSM Modems modules and display section for user. This system would be able to expect the time as well position to display on the LCD at every defined user locations. The software part includes the monitor part and IDE part. A Graphical User Interface (GUI) and software management package are also developed to monitor

and maintain the system. MPLAB has been selected for as the IDE and C18 as the compiler for the advanced controller unit so both the hardware and software solutions are integrated in the proposed system to make it most reliable and user friendly. This required core software used for programming the setup and creating a replica of the real network. The sensed inputs are being applied to high-tech chip, whose job is to continuously produce correspondent outputs and display it. Individual unit is connected to master node using a wireless connection, this master node containing Network Operating centre (NOC) and automated monitoring server. The technique applied to minimize the peak energy consumption is the pre-defined variable energy packages resulting in motivating user to change his consumption habits. The algorithm proving to be real application of embedded systems for monitoring in power system networks.

The paper organization is as follows. First part refers to introduction, a brief history of embedded system, their penetration in daily life and becoming a common interest for today researcher. Second part discusses the related work done by different people for development of embedded systems and standards achieved by them. The methodology part is the system description in detail, how all process is carrying out within the system. It also includes programming and GUI description for designed algorithm. Results and discussion explains the level of work done and accuracy of the values obtained as output. But number of possible user able to communicate with server is still a question needed to be solved. Security of the system a also section to be addresses yet.

Related Work and contributions

History of Embedded system

The History of Embedded system goes way back to the sixties. However, the system developed those days couldn't penetrate themselves for the common man due to their prohibitively high cost and limited portability. An Article from Embedded Technology Journal quotes:"With the attributes mentioned in previous heading, it is clear that such a system could have been developed with only with the advent of microprocessors. To briefly trace the history of embedded systems architectures, we have moved rapidly from system-in-chassis to system-on-board, then into system-on-chip (SoC) integration over the past decade. Each time we have integrated, our power density has increased as our form factor shrank. Interestingly, today, embedded systems have more in common with supercomputers than with commonly desktop and laptop machines." It is further analyzed that both supercomputer and embedded computer have hit the wall of diminishing returns on single thread, Van Neumann processors and have moved into the domain of multi core and alternative processing. It has been reported that, the first embedded system to be produced in large quantities was the Autonetics D-17guidance computer which was used in Minutemen Missile released in 1961. It was built from discrete transistor logic and had a hard disk for main memory. The real era of embedded dominance took off in 1962, with the foundation of the PC/104 Consortium by Ampro, RTD, and other manufactures. The group established a format for Intel microprocessors based on a motherboard approximately four inches square, and just under an inch high. The board was stackable, allowing a very powerful computer to be assembled in a box approximately four inches square or even less. [6]

The embedded systems design considers the systems characteristics and restrictions that are fundamental for an efficient system function. As a result, low power design of communication intensive real-time embedded systems must consider the environment and application constraints to optimize the system's design [7], such as real-time responsiveness and intensive execution of communication tasks.

Real Time Monitoring

Unlike general-purpose operating systems, RTOSs often sacrifice some functionality for the sake of compactness, predictability, and speed. A number of services typically provided by general-purpose operating systems are not useful in most embedded applications, e.g., support for multiple users or complex file-systems. By omitting such features, the size of an RTOS may be reduced, decreasing memory requirements and, therefore, embedded system cost. General-purpose operating systems usually try to complete their duties quickly. However, they typically do not provide a hard guarantee that a task will complete by a certain time. RTOSs differ from general-purpose operating systems by making hard real-time guarantees about the time requirements of the critical services they provide.

Typical applications involve significant use of RTOS primitives, the complex interactions among which are hidden from the application software developer. Although abstracting away the detailed behavior of RTOS services allows embedded system designers to more easily manage complexity, tight performance and power constraints sometimes demand more detailed analysis. The way an RTOS is used has a significant impact on embedded system performance and power consumption. Therefore, designers need to be aware of the impact of RTOS on these design characteristics. Therefore, designers need to be aware of the potential performance and power impact of RTOS use[8].

Real Time Monitoring in power systems and networks

A recent research in India shows that embedded system has become very popular in monitoring and

control systems. A. Goswami designed experimental modal for monitoring and controlling temperature and light using a simple micro controller shows the accuracy in results obtained in this process. The accuracy indicates how closely the sensor can measure the actual or real world parameter value. The more accurate a sensor is, better it will perform. The Writer used the micro controller not a very much updated, and the system was not capable for offline analysis of data [9].

Muhammad Mehroze Abdullah proposed a Smart Demand-Side Energy Management Based on Cellular Technology stating that, detailed information about consumption of electricity is not provided to users and network operators, which is prime wastage of electricity [10]. The writer didn't clearly explain the standard of communication used; also cost effectiveness of the system is still a question mark. The system proposed is designed for individual and no enough focus on overall system operation, how this system can affect the peak load demand.

Taiwan is also developing country and its electricity statistics are having few similarities with Malaysian energy profile as mentioned below.

- *The lack of indigenous energy resources*: Dependence on imported energy resources
- *The use of fossil fuels as the primary energy sources*:
- *Current limited utilization of renewable energy*: Despite ongoing development the utilization of renewable energy is presently limited due to technical constraints, high unit cost and comparative instability. The cost of renewable energy is still too expensive to be widely applicable for domestic power generations.

The authorities in Taiwan set an implementation plan for short time management of electricity, mainly focusing on creating awareness among user by providing the actual awareness among them using different mean. According to authorities all sectors need to be addressed to manage this growing challenge through public awareness campaign. But there is no way out to get feedback and follow up after this huge campaign. This awareness scheme even having motivation among users but practicable system to control over peak load problem. There is no clear way to see how affective this system is?

Our algorithm offers using some source of energy monitoring device to get actual consumption awareness, surely resulting in positive achievements. Designed pro-type is highly target oriented and successful in achieving the EMS (energy management system) and it proved to be very convenient in real time pricing [11]

Energy overview for Malaysia

To meet increasing requirement of electrical load, highly requires new generation, making current resources more efficient and output oriented. Sometime Upgrading or replacing the transmission lines is also necessary. Replacing some of the infra structure need 10-15 years [8]. While peak demand is projected to increase over the next ten years by 19%, meanwhile transmission miles are projected to increase less than 7%. This gap is a red zone resulting into huge crises strongly needs some management to minimize this gap until requirement is fully achieved. [12]

System Design and description:

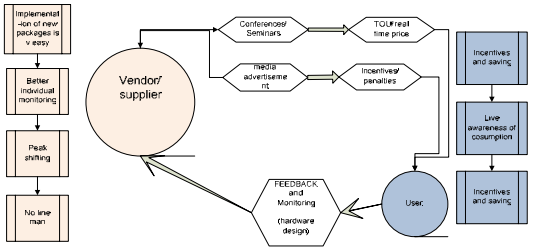


Figure 2 System flow diagram between vendor and user is followed by some stages, feedback and monitoring is to make sure implementation of the packages provided.

Hardware Implementation

The remote node can be selectively configured to provide master-slave topology, or to form Stand-Alone, i.e. digital power Monitoring system. In the left side of Fig1, the Current transformer acts as a front-end signal acquisition system, as it provide main input signal to be processed. This signal is digitized in current to voltage convertor, amplifier circuit. This signal is processed in controller according to highly pre-defined program and output through MAX232, a level shifter IC is sent to GSM Modem for further operation.

The job of micro controller is to perform all calculation, based on I and V pulses and to calculate amount of energy used according to a pre-defined equation, and to generate cost for this consumption taking in consideration the defined electricity packages, i.e. real time monitoring and calculation.

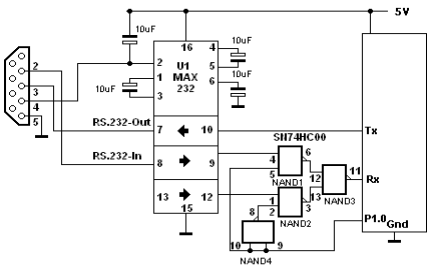


Figure 3. Shows GSM pin Connection to microcontroller.

GSM modem supported by AT commands is connected to micro controller to transmit data according to pre-described time period to central base station. GSM modem use SMS technology. To send or receive any SMS or to display any SMS in the inbox which is actually the information of the consumption, there are some specific commands.

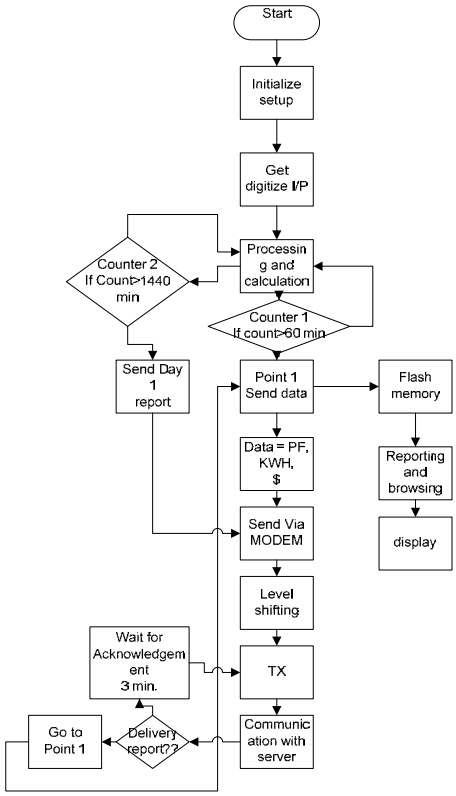


Figure4. System flow chart, shows mechanism of operation for energy detective.

CONCLUSION

It is therefore concluded that product-integrated energy feedback with a planned motivation to users, when coupled with a means for the user to set an energy conservation goal, offers a convenient and highly successful means to save energy. Even though for some user when calculated the average use is slightly more than before but peak is still having good marginal progress. Few of complaints also received about technical difficulties of system, but these were less than 10%. Till this time only prototype of system is installed and examine for a limited number of users only, more detailed study need a wide network with more efficient monitoring system which is in phase of development, specially to avoid calculation, need a monitoring and analyzing software later on.

Maximum care was taken in both the selection of subjects and the design of the experiment in order to assure ecological validity accuracy and precision of values. Some issues like delay in message delivery also needed to resolve yet, but this is a system error happening. However, without using a larger sample or an extensive cross section sampling, affects of group differences cannot be ruled out. Neither can ecological validity be assured without replicating the results in a field study. Nonetheless, the robustness of the results should encourage researchers to join in a more extensive investigation of the links between motivation and goal-setting in the energy conservation domain.

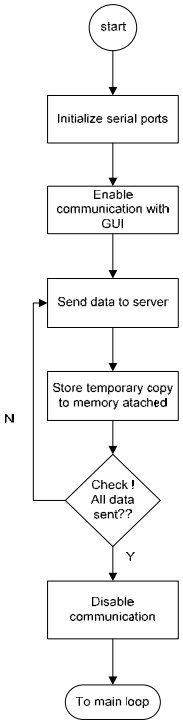


Figure5. System Flow chart description at remote end, Calculation and transmission of information.

Enhancement section of the research includes addition of pre-paid section, adding graphical display and some alarming portion to user. Automatic shut down system with user pre-information also is an hot issue under consideration.

It is becoming important to have such a system which helps to manage consumption on the basis of real time pricing, with a secure and live mentoring device friendly to both user and supplier, especially in case of developing countries because smart grid concept is no doubt overall solution but it is not feasible for low budget economies. Smart Grid technology is still new and has yet to develop acceptable standards.

Our algorithm offers using some source of energy monitoring device to get actual consumption awareness, surely resulting in positive achievements. Designed pro-type is highly target oriented and

successful in achieving the EMS (energy management system) and it proved to be very convenient in real time pricing. The prototype is tested for a few users for defined time and after peer monitoring, it showed a healthy response in order to achieve targets.

The technique presented in this work provides a very highly technical monitoring means for the digital measurement of electrical energy, which may be used over a wide range of energy measurement. The results obtained exhibited linear behavior over the range used. The apparatus gave good results under various loading conditions and with a power factor ranging from low to high values. Actual use and result of this system will be obtained after implementation to a specific area but estimated accounts will be eliminated and customers will pay only for what they actually use.

ACKNOWLEDGEMENTS

The researchers thank the Faculty of Electrical and Electronic Engineering, who funded the project with resources received for research from university Malaysia Pahang.

REFERENCES

[1] Thaddeus, J. (2002) Complementary roles of natural gas and coal in Malaysia, *Proceedings of the 8th APEC Coal Flow Seminar/9th APEC Clean Fossil Energy Technical Seminar/4th APEC Coal Trade, Investment, Liberalization and Facilitation Workshop.*

[2] Abdul Rahman Mohamed and Lee Keat Teong, *Energy Policy for Sustainable Development in Malaysia. 9-028 (O) The Joint International Conference on "Sustainable Energy and Environment (SEE)"1-3 December 2004, Hua Hin, Thailand.*

[3] Martunus, M.R. Othman, r. Zakaria, w.j.n. Fernando. *Co2 emission and carbon capture for coal fired power plants in Malaysia and Indonesia*. International Conference on Environment 2008 (ICENV 2008).

[4] W. Wolf, *Computers as Components - Principles of Embedded Computing Systems Design*. Morgan Kaufman Publishers.

[5] P. A. Laplante, *Real-Time Systems Design and Analysis*, I. Press, Ed., 1997 "Exploring C for microcontrollers" by Jivan s. Parab, V.G.Shelake, R.K.Kamat, G.M. naik. ISBN 987-1-4020-8392, p4.

[6] W. Wolf, *Computers as Components - Principles of Embedded Computing Systems Design*. Morgan Kaufman Publishers.

[7] Robert P. Dick, Ganesh Lakshminarayana, Anand Raghunathan, and Niraj K. Jha, *Analysis of Power Dissipation in Embedded Systems Using Real-Time Operating System.* IEEE TRANSACTIONS ON COMPUTER-AIDED DESIGN OF INTEGRATED CIRCUITS AND SYSTEMS, VOL. 22, NO. 5, MAY 2003

[8] A.Goswami, T. Bezboruah2 and K.C. Sarma, *Design of an Embedded System for Monitoring and Controlling Temperature and Light*, International Journal of Electronic Engineering Research Volume 1 Number 1 (2009) pp. 27–36.

[9] Muhammad Mehroze Abdullah & Prof. Barry Dwolatzky, Smart Demand-Side Energy Management Based on Cellular Technology - A way towards Smart Grid Technologies in Africa and Low Budget Economies, IEEE AFRICON 2009, 23-25 September , Nairobi, Kenya.

[10] Yun-Hsun Huang 1 and Jung-Hua Wu. Energy Policy in Taiwan: Historical Developments, Current Status and Potential Improvements. August 2009. Sensors. MDPI, ISSN 1996-1073.

[11] U.S department of Energy, *the Smart Grid an Introduction* (Washington DC: US dept of Energy, 2008, http://www.oe.enery.gov)

[12] Adapted from NLDC Malaysia, on December 2009. Non published material.

Effect of Bio-organic Fertilizer and Inorganic Fertilizer on Oil Yield of Patchouli (Pogostemon cablin)

Che Norihan Che Wahab*, Rohaida Che Man, Rosli Mohd yunus, Siti Khodijah Abd. Mudalip, Siti Zubaidah Sulaiman, Fathie Ahmad Zakil, Syalida Mohd Saarani@Nawi, Wan Salwanis Wan Mohd Zain
Faculty of chemical Engineering and Natural Resources, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26700 Kuantan Pahang, Malaysia.
*Corresponding author: chenorihan@gmail.com

Abstract
Patchouli is a herb growing in a number of countries in South East Asia and the patchouli oil yield was used as ingredient in toiletries, cosmetics, breath fresheners, incense, insecticides, disinfectants, commercial food flavouring and most commercially used in perfumery industries (Bown., 2001). In order to gain the highest production (oil yield and oil quality) from patchouli plants, two types of fertilizer was used in this research for the comparison purpose namely, bio-organic fertilizer and inorganic fertilizer. The objective of this research is to identify the best fertilizer which contributes to the highest patchouli oil yield and patchouli oil quality. The patchouli oil yield was extracted from dried leaves by hydro distillation extraction and oil quality was measured by gas chromatography-mass spectrometer (GC-MS). The results indicated that the bio-organic fertilizer was the best fertilizer contributed to the highest oil yield and oil quality which is 3.2% and 42.11% respectively compared to inorganic fertilizer, 1.8% and 42.11%, and control (no fertilizer applied), 1.2% and 36.8%, respectively. As a conclusion, bio-organic fertilizer was chosen as the best fertilizer for the highest patchouli oil yield and oil quality. Hence, the utilization of bio-organic fertilizer will reduces the environmental pollution instead of inorganic fertilizer which will contribute to the high environmental impact.

Keywords
Fertilizer; Patchouli; Oil yield; Oil quality

INTRODUCTION

Patchouli (Pogostemon cablin) oil is one of the important natural essential oils used to give a base and lasting character to a fragrance perfumery industry. The dry leaves of patchouli on hydrolysis distillation yield called the oil of patchouli. Indonesia is the major producer of patchouli oil in the world with an estimated 550 tons per year, which is more than 80% of the total (Robbins, 1983; Tao, 1983). Fertilizers are used to supply essential nutrients that are important for the plant growth. Plants respond differently to different compounds and nutrients that are readily available in soils or fertilizer (Gimeno-Garcia et al., 1996). Fertilizer rich nitrogen promotes green, leafy growth but too much can prevent fruiting or flowering while the fertilizer high in potassium and phosphorus are used to boost flowering and fruiting as plants consume large amount of these nutrients .The quality of the patchouli essential oil is measure with the higher contents of patchouli alcohol, α-patchoulene and α-bulnesene which are important constituents to regulate the aroma of oil (Husain, 1994). In this study, patchouli (***Pogostemon cablin***) was chosen because The Herb Society of Malaysia has identified the local herbs including patchouli have potential to be commercialized in Malaysia according to their very good demand in national and international markets. Hereby, the objective of this study is to compare the effect of bio-organic fertilizer and inorganic fertilizer in terms of oil yield and oil quality of patchouli oil.

MATERIAL AND METHODS

Patchouli Grow in the Greenhouse

Patchouli seedlings were pre-grown in a polyethylene filled with the top soil with ratio 3:2:1 (sheep manure compost: red sand: soil) covered greenhouse (70% transparency to visible irradiation) for two months.

Figure 2.1 Patchouli seedlings

Patchouli Transplantation

After two months grow under sun shade, they were transplanted in the open plantation whereby the organic fertilizer (sheep manure) had already been incorporated into the soil of the respective plots down to a depth of about 15cm, 2 weeks before transplantation day. The experiment plot consisted of 25 patchouli plants placed in 5 rows of 5 plants and there were three replicates plots per treatment.

Fertilization treatments were compared consisted of: (i) bio-organic fertilizer supplied by Lembaga Kemajuan Perladangan Pahang (LKPP), (ii) a chemical fertilizer supplied by Hadzrin Landscape Nursery and (iii) a control treatment in which no fertilizer was applied. The fertilization treatment was done for four months. Plants of control and fertilization treatments were irrigated through separate pipes with water only.

Figure 2.2 Patchouli plantation

Harvesting Period

The patchouli plants were harvested by cutting the stems at 15 cm from the soil level after six months. The most suitable harvesting time for the patchouli is at the early morning. After harvest, the weight of the plants was determined, then the leaves were air-dried under direct sunlight exposure for five hours, and dried under close place for seven days until the water content reached about 15%.

Extraction of Patchouli Oil

The harvested plants were extracted for their oil yield by hydro distillation extraction. The lab scale extraction unit was used in this research. The extraction was done for six hours and standardized condition to all samples.

Figure 2.3 Hydro distillation extraction

Oil Quality

The patchouli oil samples which were extracted were analyzed for oil quality by GC-MS fitted with 30m x 0.25 mm i.d capillary column coated with 0.25 µm film 5% phenyl methyl siloxane. The column temperature was at 80°C for injection, temperature program began at 10°C min^{-1} to 110°C, then at 3°C min^{-1} to 120°C and held for 10 min. Furthermore, the temperature was increased at 2°C min^{-1} to 134°C, at 1°C min^{-1} to 134°C and held for 5 min, then at 5°Cmin^{-1} to 240°C and held for 5 min. Split injection (2µl) was conducted with a split ratio of 1:10 and helium was used as carrier gas of 1.0ml min^{-1} flow rate. The spectrometers were operated in electron-impact (EI) mode, the scan range was 40-550 amu, the ionization energy was 70 eV and the scan rate was 0.34s per scan. The inlet, ionization source temperature were 250°C and 280°C, respectively.

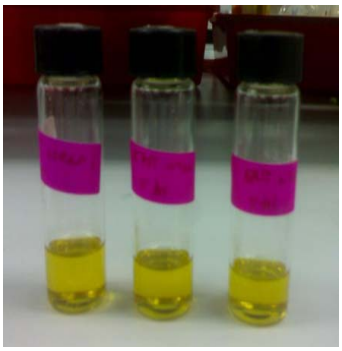


Figure 2.4 Patchouli oil yield

RESULTS AND DISCUSSION

Effect of fertilizers for patchouli production (oil yield and oil quality)

The results obtained were shown in figure 1 and figure 2.

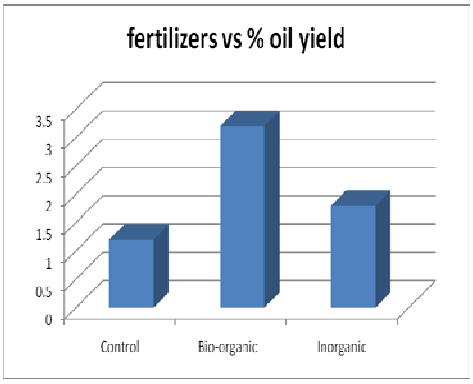


Figure 3.1 Fertilizers vs. oil yield

Figure 3.1 and figure 3.2 above shows the percentage of patchouli oil yield and patchouli alcohol (PA) from the patchouli leaves which applied with bio-organic fertilizer and inorganic fertilizer. Based on Figure 3.1, bio-organic fertilizer resulted in highest oil yield which is 3.2% compared to inorganic fertilizer, 1.8% and control (no fertilizer applied) resulted as lowest oil yield, 1.2%.

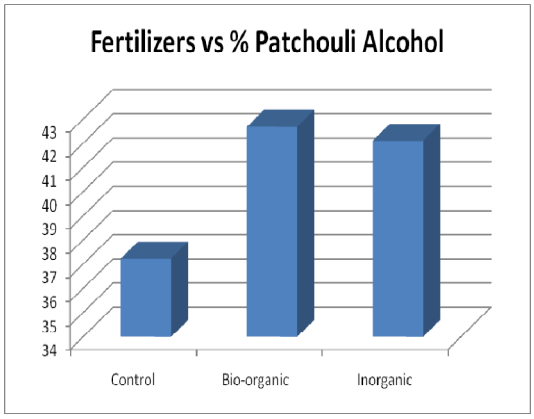


Figure 3.2: Fertilizers vs. % patchouli alcohol

The quality of the patchouli oil is measure with the higher contents of patchouli alcohol which is important constituent to regulate the aroma of oil (Husain, 1994). Based on figure 3.2, the bio-organic fertilizer resulted the highest oil quality which is 42.68% compared to inorganic fertilizer, 42.11% and control 36.8%.

In perfumery industries, the highest oil quality of patchouli oil is crucially necessary to gain the price increment and market demanding purpose.

CONCLUSION

As a conclusion, bio-organic fertilizer was chosen as a best fertilizer compared to inorganic fertilizer because of the highest oil yield and oil quality result. Furthermore, bio-organic fertilizer has been identified as an alternative to inorganic fertilizer to increase soil fertility and crop production in sustainable farming and prevent the chemical impact of agricultural activities on the environment as well.

REFERENCES

[1] Gimeno-Garcia, E., Andreau, V., Boluda, R., 1996. Heavy metal incidence in the application of inorganic fertilizers and pestisides to rice farming soils. Environ. Pollut. 92, 19-25.

[2] Husain, A., 1994. Essential Oil plants and Their Cultivation. CIMAP, Lucknow, pp. 136-140.

[3] Robbins, S.R.J., 1983. Natural essential oils. Current trends in production, marketing and demand. Perfumer and Flavorist. 8, 75–82.

[4] Tao, C., 1983. China's burgeoning aromatic industry. Perfumer and Flavorist. 7, 1.

Multi-Microcontroller Evaluation Tool For Education In Embedded Control Technology: The Ump-Evt

R.S.K. Selvakumar[1], K.H. Ghazali[2], N.M.K. Nik Yusoff[3], H.AbdulAziz[4]
Faculty of Electrical & Electronics Engineering, Universiti Malaysia Pahang,
26300 UMP, Kuantan, Pahang, Malaysia; Phone: +6012-9631397
E-mail: inderjit_1791@yahoo.com[1], kamarul@ump.edu.my[2], nik@ump.edu.my[3]
, hazizulden@ump.edu.my[4]
Corresponding Author: inderjit_1791@yahoo.com[1]

Abstract
In traditional Embedded Control Technology courses, students learn to develop assembly language programs to control peripherals, handle interrupts, and perform I/O operations. Designing and programming of embedded systems require skills that need training and practice. The main problem of such approach is its focus on only one device type with other microcontroller families requires other development boards. This aspect becomes important in a university laboratory, where students have to work with different types of embedded systems. For example, in our Faculty of Electrical & Electronics Engineering, three 8-bit are used in different projects. Each microcontroller type requires its own development board with its own set of peripheral devices; this is a waste of resources and so came the idea to use the same set of peripherals on a mainboard and to plug in anapplication board with a specific microcontroller and its associated circuitry. A new laboratory evaluation tool (UMP-EVT) specifically will be designed to be as a learning tool for those who intend to learn microcontroller and for use in the academic environment. One mainboard and three application boards were designed and tests were performed. In this respect, this UMP-EVT would be applicable for education and expose the electrical engineering students to the understanding fundamental of microcontroller in electronic design field.

Keywords
Educational, MCS51 microcontroller, HC11microcontroller, PIC microcontroller

INTRODUCTION

Research and education activities at Faculty of Electrical & Electronics Engineering, Universiti Malaysia Pahang involve embedded systems design anddevelopment. There are currently running around 30research projects and student courses ranging fromsemester 3 to semester 7[1]. Every year, there are Embedded Control Technology course available for third year diploma and degree and also for students from our faculty who taking

final year projects [2].All theseactivities require different microcontroller types, eachwith its own development board, but structure of suchboards is very similar, only microcontroller and itsassociated circuitry being different [8].

The aim ofpresented work is to design a development board forembedded systems suitable for differentmicrocontrollers that are connected through several types of application board[4].Experience gained in last research projects (MCS51 Educational Development System [1] and MC68HC11A1 Microcontroller Laboratory Hardware Platform – MINI11 [2]) lead to anew design – the UMP-EVT for8 bit microcontrollers, Freescale HC11, MCS51, and Microchip PIC 16 Series.

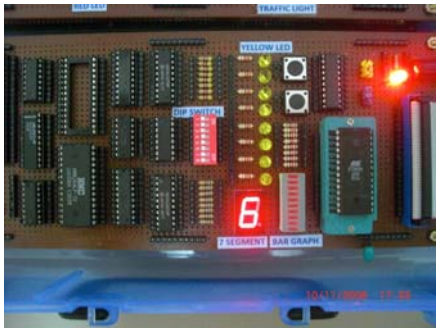


Fig 1: MCS51 Educational Development System

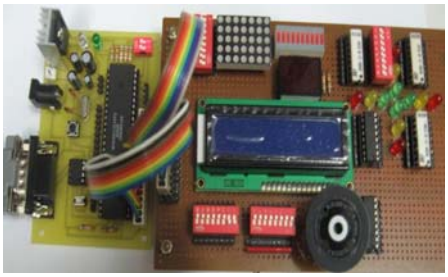


Fig 2: MC68HC11A1 Microcontroller Laboratory Hardware Platform – MINI11

The idea of many available peripherals from first project was combined with flexibility of application board plug in second design [8]. The resulted system is expected to have 2 qualities: cheap (no more than RM

300 per mainboard plus one application board) and flexible (open structure for application board, future expandable for easy to handle new types of application devices).

In this paper, we are going to propose such a systematic approach for hardware implementation and discuss how it could be used successfully in embedded system education of this UMP-EVT in ECT class. This paper presents the importance of microcontrollers course in education syllabus and the design of UMP-EVT that is based on 8-bit microcontroller Atmel® AT89C51, Microchip® PIC 16F877 and Freescale® MC68HC11. It begins with the discussion of the hardware implementation of the system. It proceeds then with software implementation of the system to be interfaced with the PC creating a user-friendly environment, followed by a discussion. Finally, a conclusion is given in section 6.

SYSTEM ARCHITECTURE

The UMP-EVTdevelopment board should contain allrequired peripherals for standard embedded systemsapplications – 5 Volt power supply, RS232 interfaces, open drain power outputs, analoguebuffered inputs and outputs, LEDs, input and output interface.Each application board contains remaining parts –obviously the microcontroller, its external memorycircuits, as well as its input and output interface.

The hardware architecture of the UMP-EVTdevelopment board is shown in figure 3; architectureof application boards is very simple, mainlymicrocontroller and some small parts for external memory interfacing circuits.The UMP-EVT development board has a similar layoutwith MCS51 Educational Development System. Other two more microcontrollers and various associates component were added. The boards contain a Freescale MC68HC11E1 device, ATMEL AT89C51 device and MicrochipPIC16F877A device. Each board contain microcontroller, clockcircuit with crystal, reset circuit and programmingconnector. Only flash-type microcontrollers werechosen because the goal is a development system sosoftware changes are often.

These voltages are available on different pins of theconnector between boards, so no switch is requiredfor voltage selection. On board voltage regulators areable to supply 1.5A on 5V rail, more than enough for a modernmicrocontroller.

Programming connector is dependent onmicrocontroller family. However, all the microcontroller system pre-programmed with monitor program which enable user to load and execute the file using RS232 interface. Every microcontroller has its own monitor program pre-program in internal and external memory.

Final circuitry of the UMP-EVT is designed for interfacing to RS232 serial ports is provided by EIA232 circuit utilizing Dallas Semiconductor's DS275 while power circuit regulates supplied voltage to 5Vdc for TTL application. I/O ports of microcontrollers are connected to connector sockets for ease of interfacing with various I/O devices. Since the development board is designed for on-chip mode, all ports are available to be explored. Figure 3 shows the complete circuit for UMP-EVT development board. This circuit is realized on a single-sided printed circuit board (PCB) for durability.

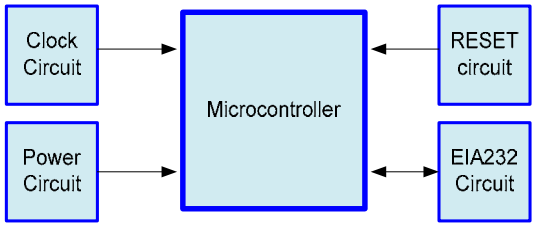


Fig 3: System Block Diagram

THE UMP-EVT SOFTWARE IMPLEMENTATION

Development of UMP-EVT software is divided into two i.e. the monitor program development and the IDE program development. Monitor program controls the entire interfacing between a computer and the UMP-EVT development board. Written in assembly language and stored in ROM, monitor program is used to perform object file loading and executing without the hassle of burn-erase-burn method usually associated with EPROM programming. This program will be stored into microcontroller internal EEPROM.

The conceptualization of the monitor program algorithm (used in Freescale HC 11) is shown in the Figure 3. The basic function of a monitor program is to read user's input from keyboard. Based on the input, it determines which procedure, either upload S19 or HEX file or execute program, to be executed. Once selected, the instruction is processed by sending the information to the development board for execution. Status of execution is feedback to user on a computer screen.

Usually running a monitor program requires the use of communication program such as Hyper-Terminal. Likewise, developing application software for microcontroller requires a text editor and an assembler to write and assemble the code respectively. An IDE program integrating programs such as communication program, cross-assembler and text editor is developed to create user-friendly development environment. This new software is developed to allow users to perform all development activities in the ever familiar window

working environment without needing to exit any program. Instead of entering instruction on command line, IDE user interface allows execution of instruction by clicking the appropriate buttons. Figure 5 shows a screenshot of the IDE program.

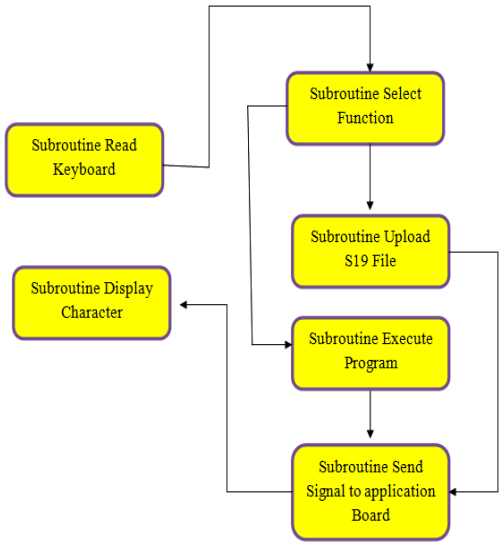


Fig 4: Concept Diagram of Monitor Software

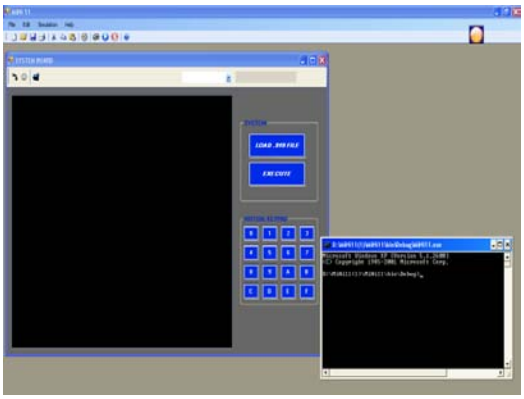


Fig 5: Screenshot of IDE program for UMP-EVT

DISCUSSION

Likewise, a monitor program will be developed, assembled, and downloaded into the EEPROM or NVRAM. Several tests of mini operating system will be tested several times and prove that the system is reliable and sufficiently stable. It will show that the monitor program is able to communicate with the computer and capable of performing several commands issued from the host.

A survey on student's understanding in embedded systems was conducted to detect the level of understanding in this course and the feedback from the students if there are develop in-house microcontroller educational development system based on the MCS51, HC11, and PIC 16 series microcontroller were developed. So far only 21 responses from the students in FKEE who replied the surveys and preliminary results are encouraging. The majority of the students found the UMP-EVT system will helpful in understanding the knowledge in embedded system. The UMP-EVT system will also helped them to better understand how the microcontrollers worked and how hardware and software worked together if the UMP-EVT are build. The instructors teaching this lab noticed that the need of this UMP-EVT system could make a significant improvement in students' performance and understanding of the lab. For more detail on this UMP-EVT system's survey, please log on into this webpage, "http://www.kwiksurveys.com/online-survey.php?surveyID=BIEIM_5d8a6dc9".

RESULT AND TESTING

After designing the UMP-EVT, the mainboardand each application board were tested by runningsimple applications for each of the microcontroller.These programs were elaborated with monitor program of each microcontroller. Allboards are functional as well as all devices frommainboard. In this project, students from second to fourth yearwere involved in manufacturing the boards withsoldering the components andhardware and software testing. From this teamwork, some new ideas occurred and they will beimplemented in next version of mainboard.

Testing of different microcontroller configurationswas helped by the existence of a common set ofsoftware modules written in C language ([2]). Thesemodules have a high level of portability and can beeasily adapted to new microcontroller families.From the costs point of view, summarized inTable1, the solution is cheap – about RM 150 formainboard and RM 10 – RM50 for each daughter board,depending on microcontroller.

The flexibility of this solution made it veryattractive for replacing other more expensivedevelopment systems. After a survey on electroniccomponent distributors, development systems withsimilar peripherals cost more than RM 1000 for allthree families of microcontrollers and offer lessfunctionality.Another advantage of presented solution becomeimportant in education activities – a flashmicrocontroller has a limited number of erase cyclesfor its program memory, catalogue data mentioningusually 10'000 cycles. Unfortunately this number isvalid in some special temperature and voltageconditions that can be easily exceeded in aneducational environment. If microcontroller becomesdamaged, replacing the device is a cheapoption compared with replacement of the entire boardlike in case of single board solution.

During development and testing stages a numberof improvement ideas occurred. First, a USBconnection

is important for working with modernlaptops that have no more RS232 interfaces. Second,connector socket on the motherboard is too much for normalapplications and consume too much board space. Third,a buzzer or small speaker is a good option forgenerating sounds and alarms. Fourth, more high-range devices wererequired for application module, like ZIGBee being considered. Finally,keyboard and LCD display should on themainboard, not connected using cables. A 2 lineLCD display is enough for normal applications. Allthese new ideas are will be implementing in this UMP-EVT system and results are expected in end of this year 2010.Presented work is a part of a research project ofFaculty of Electrical & Electronics Engineering, Universiti Malaysia Pahang.

ACKNOWLEDGEMENT

Financial and management support from the Universiti Malaysia Pahang through short-term funding vote RDU090344 is acknowledged with gratitude.

CONCLUSIONS

Modern system-on-chip microcontrollers offersimple solutions for control applications at affordableprices. Software development tools for differentmicrocontroller families tend to have similarinterfaces, especially if coming from the samesoftware house, but hardware tools (developmentboards) are specific to microcontroller families.General trend presented in software industrytowards open architectures and systems is for momentnot valid for development boards. This work tries tomake a step further in this direction of makingdevelopment platform independent of selectedmicrocontroller solution.Presented solution for development in the field ofembedded systems is a part of anelectronic projectfor evaluation tool systems and has greatpotential for education – is low cost, flexible and hasan open architecture. It is also worth to mention thatwas elaborated together with a number of lecturers within same faculty of Universiti Malaysia Pahang.

REFERENCES

[1] Databeans (2010, March), 2009 Microcontroller Market Share [online], Available: http://www.electronics.ca/publications/products/2009-Microcontrollers-Market-Share.html

[2] M.Z.B.M.Sapein,"*MINI 11-Microcontroller Laboratory Hardware Platform with IDE Approach*", Thesis University Malaysia Pahang, 2009

[3] T. Stoltz, M. Paulik & N. Al-Holou, "A Microcontroller Laboratory Hardware Platform for the Academic Environment: The UDM-EVB," in *Proc Frontier in Education 35th Annual Conf, FIE'05*, Indianapolis, IN, 2005, pp. S2G-1 – S2G-6

[4] A.K.M Azad & V.K. Lakkaraju, "Development of a Microcontroller Laboratory Facility for Directing Students towards Application Oriented Projects," in *Proc American Society for Engineering Education 2003 IL/IN sectional conference*, Valparaiso, IN, 2003, pp. 145-151

[5] Cady (2010, July 23), M68HC11 Microcontroller Board and Prototyping [online], Available: http://www.coe.montana.edu/ee/cady/ee361/hc11lnks.htm#student_evb

[6] L.C. Ling, "*The MC68HC11 Development Board with Integrated Development Environment (IDE)*", Thesis University Malaysia Pahang 2008

[7] K.C. Seong "*The MC68HC11 Development Board*", Thesis University Malaysia Pahang 2007

[8] R.S.K Selvakumar, N.M.K Nik Yusoff, H. Abdul Aziz, "MCS51 Educational Development System with IDE Approach," in *Proc International Conference on Software Engineering and Computer Systems 2009 (ICSECS09)*, Kuantan, Pahang, 2009, pp. 434-437.

Intelligent Urban Transport Monitoring System Based on Concurrent GPS & RF Real-Time Positioning Technology

Muhammad Rauf, Ahmed N Abd Alla, Azhar Fakharuddin
Faculty of Electrical and Electronic Eng., University Malaysia Pahang, Kuantan26600, Malaysia

Abstract
Now days, increasing requirement scale of public transport lead this industry and passengers to face many challenges. Out of some, the most concerning is lack of proper and optimized buses monitoring and station reporting system. By providing some attractive facilities to the suffered passengers by modern technology cooperation can bring this industry up to the mark. In this paper, it is developed a novel idea for Multi ID buses monitoring system which incorporates the power of concurrent Global Positioning System (GPS) and RF Communications modules for real-time positioning, frontend intelligent and server based management software is proposed. In addition to some fundamental functions such as real-time monitoring, some featured functions are tightly combined to make the system compatible with the daily operations of any public transport scheme.

INTRODUCTION

In a global view of urban transportation, the development of urban mobile transportation in the world's industrialized countries emphasis on developing public transit network due to increment of population and also migration of people towards the urban areas. Because of scarce land resource, dense population in cities, and generally low income, developing urban public transportation has become the priority choice. So the increasing demand of public transport seems not capable of holding the promise to provide the basic facilities to the passengers due to several more reasons too. Now a day, passengers want to get the clear information of the parameters like their desired bus location and its approx. estimated time of arrival etc. at the station.

With the popularity of general purposed GPS receivers becoming consumer electronics, GPS has been emerging as a convenient tool for positioning and navigation purpose in the transport monitoring and management system. In order to achieve an optimal design of a Public transport transit system, researchers have in the last several decades proposed many design and optimization approaches utilizing GPS [1] and multiple technology approaches. like Kai Qin et al.'s proposed system [3], about to the entire system using the existing GPRS network to transmit information collected from the GPS module to the IP-fixed control centre in the internet. Hu Niu et al. developed a navigational system in [4] for overall solution on Beijing Bus Monitoring System (BJ-BMS) based on GPS satellite positioning and ground moving control system. The ground moving control system was divided as on-board GPS terminals, GPRS mobile communication network, transmission centre server, client background program and GIS interface. Ming Lu et al.'s article [7] is based on Positioning and tracking of construction vehicles in highly dense urban areas. In his paper, he reviewed previous radio frequency (RF)-related research in construction and further evaluate the pros and cons of several RF-based technologies including GPS, RFID, and Bluetooth for monitoring and applying GPS for tracking construction vehicles in a dense area by conducting extensive field tests. Some intelligence based research also been done like in [5], [8] but still the related art clearly describe that in the vast areas of Inertial Navigation System, the key issues are the consistent monitoring System with reliable error compensation using maximum faultless techniques. This paper focus on developing a new buses monitoring system based on intelligent system. The package of designed embedded system consists of the advanced control technique comprising of master part, mounted on the Bus, containing 32bit MCU integrating GPS receiver [6], long range wireless transceiver Xstream RF Module (IEEE 802.15.4). While the slave part, mounted on every bus station, also contains same MCU, this time integrating the graphical LCD and same wireless protocol. This system would be able to expect the time as well position to display on the LCD at every Bus stations found at every particular route, in the convenient way for the persons come to Bus. This required core software used for programming the setup and creating a replica of the real network.
This paper organizes, second section introduce referred technologies. Third section contains overall system architecture of bus monitoring system. Forth one proposes the system frame work with implementations techniques. The fifth part talks about the experimental results and finally sixth segment gives the conclusion and its future enhancements.

THE REFERRED TECHNOLOGIES

A. The GPS system

The GPS system [6] consists of 24 satellites in orbit around the earth, positioning is available 24 hours a day all around the world. GPS satellite actually transmits two power radio signals, termed as L1 and L2. The GPS used by the civilian is L1, having frequency 1575.4MHz in the UHF-band. It contains a Pseudo Random Noise code along with Ephemeris and

Almanac data. Ephemeris data contains a very precise orbital and clock correction message as well important information about health of satellite while the almanac data consists of coarse orbit and status information for each satellite in the constellation, an iono-spheric model, and information to relate GPS derived time to Coordinated Universal Time (UTC).

B. The Communication tool:

Wireless data communication technology is the core technology in collecting position data and operating information for most of the monitoring and management system. Now a day, the wireless technologies are growing day by day. Many enhancement and innovations are going to be observed in the field of wireless. Beside satellite communication, long range point to point or point to multi point communication protocols have been developed. That's why many researchers are keen to utilize this rising wireless technologies like in [2-4], [7], [9] especially in the transportation based navigation systems. The increasing utilization of this technology in almost every walk of life encouraged us to use in our research project. For the purpose specially designed long range XSTREAM RF modules are selected. The XStream module provides OEMs and integrators with reliable, long-range wireless data communications.

PROPOSED FRAME WORK

A. The Concepts

According to the presented invention, the GPS based multi ID buses monitoring system is a first embodiment of the Buses navigation system in which accuracy measures and planed embedded system designing are also given importance. Structure of the presented Bus monitoring system is differentiated into two major parts, containing master and Slave 1 and 2. Firstly the GPS module is provided with signal received from satellite by GPS antenna typically considered as the Input to the master part. Secondly after tracking the position coordinates, the advanced wireless protocol is utilized to transmit the acquired signal if the coordinates matching by Control unit is success, to the Slave part 1 and so on. This is considered as the output to the Display as the Real time position monitoring. In Fig.1 there is shown an overall GPS navigation system that incorporates the aspects of proposed invention.

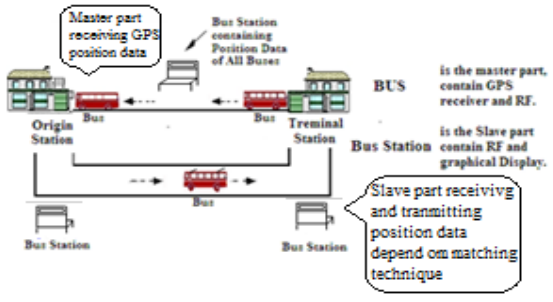


Figure 1 Buses Monitoring System, 1st concept

The 2nd concept of the proposed methodology is carried out by managing the actual utilization of the entire technologies as described in the technical background. The frame work is designed such that the victim passengers can see their desired bus location on their Bus stops. Many time buses having same IDs come together. Some time Bus stops are found in front of each other across the road. The solution suggested for the troubles found are the scheming of GPS based monitoring and their location transmission to the specific bus stops only found on their routes. The dispatching procedure is made compatible by using the prescribed assumptions. Through described resolutions, it will be easy for the passengers to take the decision either to wait for the bus or not. The designed decision support system will also facilitate the public transporters either private or managed by government in term of monitoring their particular vehicles since the system is also capable to manage the display at the any centrally organized monitoring system because of usage of power full technologies.

B. Overall System flow:

Since this paper proposes and implements a low cost object tracking system using GPS and Succession of RF Transceivers. The system allows a user to view many live monitoring features based on present and the past positions recorded of a target object. So in order to initialize the system and continue it in the most convenient way, the Bus operator has to be input some current data like Bus unique ID, time of depart and another sign like either UP or Down (Input information by Bus) and surely provide the output to all the Bus stations appear in the particular bus route, for example GPS map display of the current location of Bus through wireless. The Intelligent system is designed to make several decision based on the scenario. Figure 2 shows the overall designing process flow of the proposed Buses monitoring system.

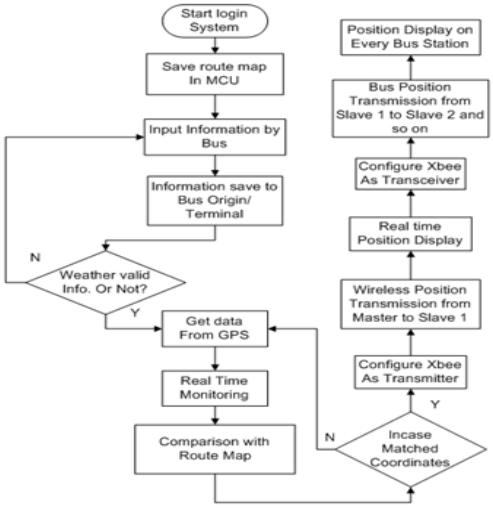


Figure 2 Process flow of Bus Monitoring System

REAL TIME IMPLEMENTATION

In the practical monitoring system using GPS, we can set certain time intervals to update Latitude, Longitude and Time data according to need in order to get the space positioning data. The GPS module used follows the NMEA0183 protocols. In most of the navigational systems, the positioning data we are concerned about such as latitude and longitude, speed, time can gain from the "$GPRMC" frame which GPS receiver sends to the MCU. So our bus positioning data can easily be selected by using this frame. Output baud rate is 4800. MCU communicate data with GPS module by serial port. This is the standard asynchronous communication mode. Set the same baud rate of MCU with GPS output baud rate, then GPS module will sent positioning data to MCU by serial port. It is programmed to allow MCU to receive and store data, and then bus location will be calculated. The main theme of paper lies in the proficient configuration of Transceivers modules based on the design scenario. These modules were also got place in the serial port. For the purpose the MCU is selected wisely and will be described in the connection designing. Complexity is ensured to reduce by dividing the whole presented system in into two basic parts; master part and slave part 1, 2 and so on, (as mention earlier) depending on number of Bus Stations as shown in Fig.3.

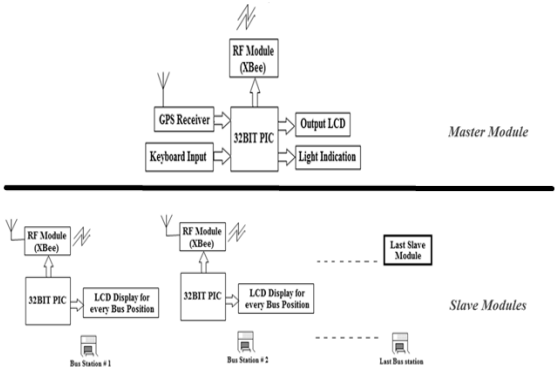


Figure 3: Implementable frame work

A. Master Module:

This designed will provide the right answer for multifaceted problems found in the existing Buses Monitoring System. Since the whole proposed system is typically divided into two basic parts, out of one is master. This part is embedded on the every bus. The system comprises the 32bit PIC produced by Microchip. MCU is responsible for receiving information, means it will receive the positioning information send by GPS module to MCU, deal with the input of keyboard information, like Bus unique ID, either UP or Down and time of departure. MCU will compare the bus position information received from GPS module with the station position information recoded in advance. In case matching, the advanced RF Module will be triggered as just transmitter first corresponding actions (such as the display of position, time of departs and the special sign to recognize either the Bus is coming from which side) by the system. In a word, MCU is responsible for the control and management of the system. At the same time it will connect the Slave parts wirelessly in order to transfer GPS data.

B. Slave Modules

Slave modules are the critical portion of the presented paper. Special algorithms are designed to operate the no. of slave modules corresponding to the no. of bus stations. So the No. of steps are described to facilitate the passengers waiting for the Bus. When the Bus (master module) is ready to move, after some data is input as described above, the master system will be configured as just transmitter first and the nearest Bus Station (slave module 1) will be configured as receiver first. So after login the system, the master module will receive the GPS signals for the Bus Location and will literally start to transmit to the first nearest Bus station. Now when the Bus is on the move, the slave module 1 will be configured as transceiver and will send the Bus Position data to slave Module 2 (2nd next Bus Station) and up to so on. This chain for transmitting, receiving and Displaying Bus Positioning information will be last till the final Bus station for every bus found in the particular route.

C. Connection Designing:

In this part, there are three key modules: MCU: PIC32MX320, GPS module SANAV FV-M8 and the advanced wireless: XStream RF Modules (IEEE802.15.4). The MCU of the embedded gateway is 32 bits MCU produced by MICROCHIP, designed to provide a cost-effective and high performance microcontroller solution for general applications. To reduce total system cost with maximum efficiency, it also provides the following: speed 80MHz, 1.56 DMIPS/MHz, 32-bit MIPS M4K Core, 2-channel UART with handshake, System manager (chip select logic, FP/ EDO/SDRAM controller), I/O ports, RTC, IIC-BUS interface and so on. For GPS module, SANAV is adopted, and its characteristic is: 32 parallel channels, Sensitivity -158dbm, 5Hz Update Rate, support DGPS technology, NMEA 0183 protocol and 9600bps. Regarding coordinates transmission, XStream® OEM RF Module is selected. The module provides OEMs and integrators with reliable, long-range wireless data communications. It is available as 2.4 GHz (worldwide) RF solution.

The main connections are shown in Fig. 4. The MCU module has two Rx/Tx channels. One is specified for the GPS and other one is reserved for the Transceiver (XStream RF Modules). We only need the MCU RxD/TxD to connect with TXD1/RXD1 of GPS. Position information can get from the GPS module. The next is to connect the remaining RxD/TxD with the wireless. This all for the Master Module while

regarding Slave Modules, the only difference is that MCU will be utilized to control the mechanism of wireless reception and transmission so no need of GPS is required at Slave Module. That why the designed solution is more reliable and cost effective and can easily be adopted by any public transportation organization.

Regarding display, the graphical LCD is selected. The main concept is designed via core programming to provide maximum benefits to the passengers. The facilities contain the current position of total buses coming to the particular stop, even if any of bus found in between two bus stops, would be shown by the arrow in between the targeted stops with poles apart IDs.

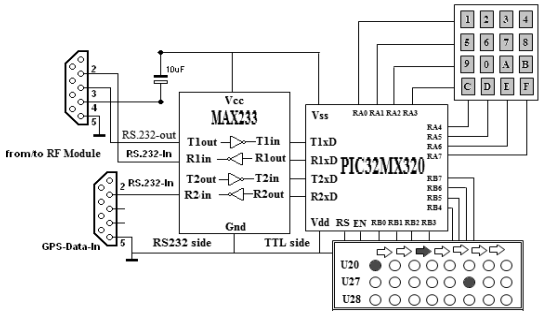


Figure 4 Generalized Connection Diagram

EXPERIMENTAL RESULTS:

This Paper explores and identifies a unique design phase contains a system to mount the GPS based embedded system on every Bus. The stand alone GPS containing system receives the raw signal and transmits at the Bus Station by RF transceivers. These specially designed long range XStream RF Modules are efficiently configured to make sure a practical communication loop only found in the particular bus Route. To achieve best real time monitoring with finest and optimum results, several data sets of coordinates are collected from a selected bus route (B103). Each of the inputs and outputs are associated with a location within a predefined region of max 20Km diameter, since the area is likely be covered by the prescribed transceivers modules.

On the basis of generalized circuit diagram, a mature prototype design is constructed and tested using collected coordinates and after utilizing pre configured transceiver modules, the transmission is checked. The NMEA message format analyzed here is the real coordinates of one of the station as;
$GPRMC, 161229.487, A, 0343.0366, N, 10307.1202, E, 0.13, 309.62, 120598, *10. From the message, our major concerns are;
Effective bits: the data following the second comma is A, indicating that this GPS message is effective;
Latitude: the data following the third comma is 0343.0366, and the following N, expressing that the North Latitude is 03 degrees and 10.0311 minutes;
Longitude: the data following the fifth comma is 10307.1202, and the following E, expressing that the East Longitude is 101 degrees and 41.5551 minutes.
After receiving the $GPRMC through Receiver to the MCU the coordinates data with exact and stored data are allowed to match by MCU. In case matching, the transceivers were activated to send the data to the next slave 1 and so on. This looping of transceiver modules gave better results especially in the dense urban areas. The activation of Transceiver modules is also the function of ID of the Bus in order to achieve the best transmission of location with exact Bus ID. Implementation and maintenance of management information system are as important as system design and development. Now this system would be able to expect the time as well position to display on the LCD at Bus stations coming on the route of particular Bus by in the convenient way for the persons come to bus.

CONCLUSION AND FUTURE ENHANCEMENT

Concisely, the design adopted a new kind of method, that is to say, MCU combined with GPS module and Transceiver modules to achieve GPS based automatic station-report function with multi ID buses movement monitoring system. Both modules were configured correctly to obtain the most efficient monitoring frame work. It can carry on the effective management to the public transportation vehicles in the most convenient way to the suffered passengers. It has many expandable functions, with considerable prospects for putting it on the market. After testing and modifications for about half a year, the system tends to be much stable and played an important role in dispatching buses and commanding public transit operations. With few workload of processing, this technique is quite feasible.

As for the future works, our focus will be on designing of centrally monitoring server based system by which the positioning data base of all the tracked vehicles could be examined. This would be help full to realize the driver efficiency as well as the factors effecting on well-organized monitoring system. For the purpose being, the magic of GSM technology will be suggested to utilize.

REFERENCES

[1] M. S. Grewal, L. R.Weill, and A. P. Andrews, Global Positioning Systems, Inertial Navigation and Integration. New York: Wiley, 2001
[2] Q.Liu et al, “Introduction of Intelligent Public Transport System-Beijing”, Jiaotong University Helps the Beijing Bus Company Say Goodbye to Paper-based Dispatching”, China Education Daily, 2008, 8-12(1).
[3] Kai Qin, Jianping Xing, Gang Chen, Linjian Wang, Jie Qin, “The Design of Intelligent Bus

Movement Monitoring and Station Reporting System" Proceedings of the IEEE, International Conference on Automation and Logistics, China, 2008, pp. 2822-7.

[4] Hu Niu, Wei Guan, Jihui Ma, "Design and Implementation of Bus Monitoring System Based on GPS for Beijing Olympics," WRI World Congress on Computer Science and Information Engineering, csie, 2009, vol. 7, pp.540-544.

[5] X. Fan, F. Jiancheng, , "Velocity and position error compensation using strapdown inertial navigation system/celestial navigation system integration based on ensemble neural network", Beijing University of Aeronautics and Astronautics, Beijing, China, August 2007, pp. 302-307.

[6] EI-Rabbany. "Introduction to GPS: The Global Positioning System". Artech House, Boston, 2002.

[7] Ming Lu et al; "Positioning and tracking construction vehicles in highly dense urban areas and building construction sites". Automation in Construction 16 (2007) 647–6.

[8] Rashad Sharaf and Aboelmagd Noureldin, "Sensor Integration for Satellite-Based Vehicular Navigation Using Neural Networks. IEEE transactions on neural networks, vol. 18, no. 2, march 2007.

[9] Muhammad Rauf, Ahmed N.Abdalla, Nik M.Kamal, Azhar Fakharuddin, Design of intelligent gps navigation system for bus monitoring and station reporting, NCON-PGR 2009, ISBN 978-967-5080814, pp 28-34.

Evaluation of Microwave Assisted Hydrodistillation Performance compared to Conventional Hydrodistillation from Dried Ginger

M.N.M. Shukri[1], N.H. Abdurahman[1] and N.H. Azhari[2]
[1]Faculty of Chemical and Natural Resources, Universiti Malaysia Pahang
[2]Faculty of Industrial Science and Technology, Universiti Malaysia Pahang
*mohdshukrimatnor@yahoo.com

Abstract
Microwave assisted hydrodistillation (MAHD) is a recently advanced technique of hydrodistillation (HD) method utilizing a microwave oven in the extraction process. MAHD has already been applied to extraction of essential oil from fresh plant materials or dried materials prior moistened. In this study, MAHD was investigated for the extraction of essential oils from the rhizome part of dried ginger (Zingiber officinale Roscoe) and the results were compared with those of the conventional HD in quantitative and qualitative analysis in terms of extraction time, extraction yield and chemical composition. MAHD resulted in a shorter extraction time compared to that in HD. Gas chromatography–mass spectrometry analysis of the extracted essential oils indicated that the use of microwave irradiation did not adversely influence the composition of the essential oils. MAHD was found to be a green technology.

Keywords
Microwave assisted hydrodistillation, *Zingiber officinale Roscoe,* Essential oil, Gas chromatography–mass spectrometry

INTRODUCTION

Ginger (*Zingiber officinale Roscoe*) is a perennial plant and grows to about 3 - 4 feet high with underground thick spreading tuberous rhizome which are widely used as spice, flavoring agent, and herbal medicine and is also employed in the perfume industry. Today ginger is cultivated in many tropical and subtropical areas, the main producers being India, China, Indonesia, and Nigeria [1]. More than 200 different volatiles have been identified so far in ginger oil. The odor of ginger is not characterized by one particular compound, but rather by a mixture of various terpenoids as well as some non-terpenoids. It has been considered unlikely that the typical aroma of ginger would ever be completely unraveled due to the enormous complexity of the oil, the many problems connected with the subjective interpretation of the odor of the individual components, and the existence of many ginger varieties [2].

Microwave assisted hydro-distillation extraction (MAHD) is based on the combination of microwave heating and dry distillation, and is performed at atmospheric pressure without adding any solvent or water [3-5]. It is an advanced hydro-distillation method based on the use of a microwave oven. The efficiency of MAHD is strongly dependent on the dielectric constant of water and the matrix [6]. This means that, the rapid delivery of energy to the total volume of solvent or sample caused by MAHD leading to a rapid rise in the temperature. Regarding to the research reported by [6], heat is originated through the molecular motions within the polar components or ionic species. Therefore, the rise in temperature within the plant cells is similar to that occurring outside the cells. Once the pressure within the glands reaches above certain level, the external cell walls break apart and as a consequence the essential oils are released to the environment [7]. MAHD is still in its infancy, as there are only a few papers published. More research many prove it to be an advantageous technique over HD even for industrial applications. Therefore, the aim of this study is to evaluate the potential of MAHD for the extraction of essential oils from dried ginger by comparing with HD in terms of the extraction time, extraction yield and chemical composition.

MATERIALS & METHOD

Sample Preparation

Fresh mature ginger rhizomes were bought in local market at Kuantan, Pahang which were imported from China. Then, these rhizomes were washed through with tap water and sliced into cross-sections about 1 mm thickness. Sliced gingers were dried in an open air at room temperature under sun shade; this drying procedure was done until 10th days to achieve 9-10 % moisture content.

Hydrodistillation

Dried sliced ginger was grinded as a ground ginger and subjected to hydrodistillation using the Clavenger apparatus for three different extraction time which are 60, 120 and 180 min. 50 grams of ground ginger sample was placed in a one litre round bottom flask containing 500 ml deionized water (1:10). The percentage yield of isolated essential oil was calculated.

Microwave Assisted Hydrodistillation (MAHD)

A domestic microwave oven (MW71E; Samsung; 800 W; 240 V-50Hz; 2450MHz) was modified for MAHD operation. The parameters of the extraction such as

materials to the solvent ratio (1:10) and extraction time (60, 120 and 180 minutes) were fixed as conventional hydrodistillation for fair comparison. The microwave oven was operated at 200 W power levels.

Gas chromatography-mass spectrometry (GC-MS) analysis

The essential oils from both extraction methods were analyzed using GC-MS model Agilent 6890/ HP 5975 with a 30m x 0.25µm, (HP-1MS, film thickness 0.25mm). The ionization voltage was 70 eV. The carrier gas is Helium; the temperature of the column initially 50 °C - 230° C (10 min) with temperature programming 3 °C/min. 1µl sample was injected and the dilution is 2% essential oils and 98% Dichloromethane (Solvent).

RESULT & DISCUSSION

Extraction Yield and extraction time Analyses

Table 1 and Figure 1 below illustrated the comparison of the percentage yield of ginger's oil between conventional hydrodistillation (HD) and Microwave Assisted Hydrodistillation (MAHD). For both HD and MAHD, the extraction starts at the boiling point of water (100 °C, if the operation is performed at atmospheric pressure). HD is an approved method that is used as reference for the quantification of essential oils [8]. Three different extraction time which is 60, 120 and 180 minutes were investigated in this study. 180 minutes (3 hours) cannot be done to the MAHD because of the overload energy which caused flux damage to the microwave as observed in preliminary experiment. So, in this study, maximum extraction time for MAHD is only 120 minutes. For 60 minutes extraction time, HD recorded 0.3906% w/w while MAHD 0.7792% w/w. On the other hand, 120 minutes extraction time for HD and MAHD showed 0.6012% w/w and 1.132% w/w respectively. Results from 60 minutes and 120 minutes extraction time present that MAHD performance is better in terms of percentage yield where 60 minutes of MAHD in range of 120 minutes for HD and even higher yield. For the 180 minutes extraction time, HD exhibited 1.2172% w/w which is slightly similar to 120 minutes of MAHD which is 1.132% w/w. These results mean a substantial saving in time. In microwave-assisted hydrodistillation, distillation time was shorter than conventional hydrodistillation and also the sample reached boiling stage more rapidly which is an advantage of MAHD when it is compared to conventional HD. This is due to the more efficient heat flow involved with microwaves. Unlike the classical conductive heating methods, microwaves can heat the entire sample almost simultaneously and at a higher rate [9]. However, Bendahou et al. [10] reported that the extraction yield by HD was greater than that by Microwave Assisted Extrraction (MAE) which is other extraction method also use microwave energy. This can be related to the differences in the properties of the solvents used in MAE and that of water, which is used in HD. Bendahou et al. [10] used hexane as solvent, which has lower solvent power compared to water used in HD. Indeed, water with a high dielectric constant absorb the radiation from the microwaves resulting in a rise in the temperature more rapidly than that in HD. Higher temperature causes an easier degradation of plant cells and consequently a shorter extraction time can be achieved [11]. According to the exhibited data, the yields of essential oil from ginger rhizomes for both methods increase gradually as increase of time which mean that extraction time influence and directly proportional to the percentage yield of the essential oil where long extraction time gives higher percentage yield. However, the yield has limitation which depends on the amount of essential oil containing in the ginger naturally.

Table 1. Percentage yield of ginger oil for HD and MAHD in different extraction time

Extraction Time (min)	Percentage yield (w/w)	
	Hydrodistillation	Microwave Assisted Hydrodistillation
60	0.3906	0.7792
120	0.6012	1.132
180	1.2172	-

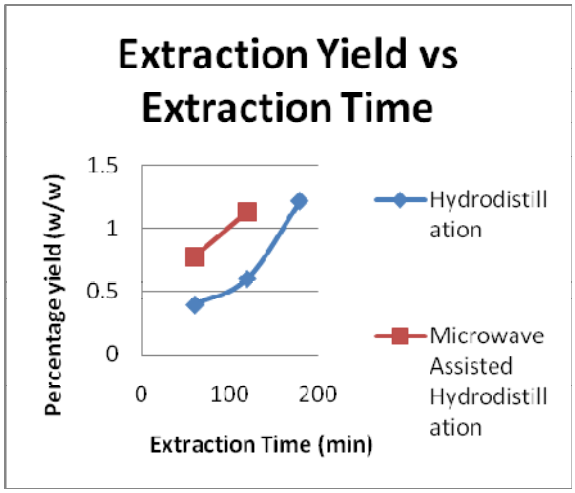


Figure 1. Extraction yield as a function of time for the HD and MAHD of essential oils from *Zingiber officinale Roscoe*.

Chemical composition analysis

Table 2 below tabulated chemical composition analysis of of *Zingiber officinale Roscoe* obtained by hydrodistillation and microwave-assisted hydrodistillation. The results were obtained from the analysis by using Gas chromatography-mass spectrometry (GC-MS). There are 25 chemical compositions found during analysis. All of these compositions not totally found in both methods, some

are only found in HD not in MAHD and vice versa as can be seen in Figure 2 and Figure 3 below where 18 compositions detected in HD and 21 compositions detected in MAHD. These compositions from both methods not totally found in all extraction time, generally the compositions which found in HD are 1R-.α.-Pinene; Camphene; Eucalyptol; Borneol; α-Terpineol; β-Citral; α-Citral; D-Germacrene; α-Curcumene; 1H-Cyclopropa(a)naphthalene; γ-Cadinene; α-Zingiberene; β-Bisabolene; β-Sesquiphellandrene; Allo-Aromadendrene; β-Farnesene; Cedrene; and α-Bergamotene. Besides, the compositions which found in MAHD are 1R-α.-Pinene; Camphene; β-Phellandrene; Eucalyptol; Borneol; α-Terpineol; β-Citral; α-Citral; β-Cubebene; α-Curcumene; α-Neoclovene; (+)-Epi-bicyclosesquiphellandrene; γ-Cadinene; α-Zingiberene; β-Bisabolene; β-Sesquiphellandrene; γ-Elemene; β-Farnesene; Cedrene; Di-epi-.α-cedrene; and α-Cedrene However, there were no significant differences between the quantities of the extracted components by HD and those extracted by MAHD. These compositions consist of about 94% to 100% of total GC peak area.

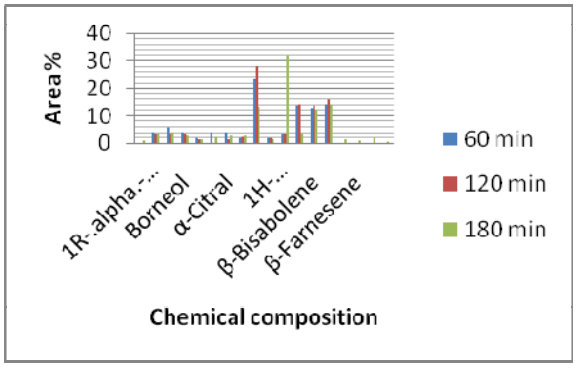


Figure 2. Chemical compositions detected in HD

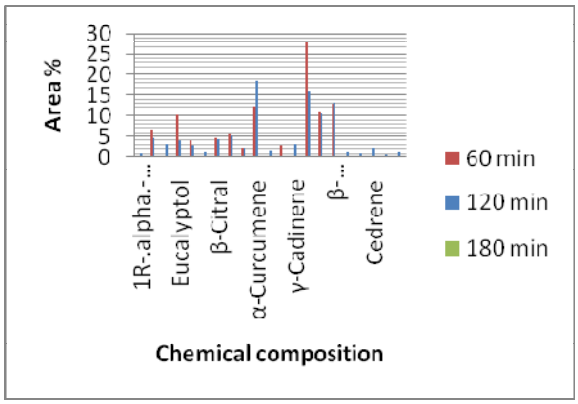


Figure 3. Chemical compositions detected in MAHD

On the other hand, there are 8 chemicals compositions were found in both methods and all the extraction time (60, 120 and 180 minutes). The compositions are Camphene; Eucalyptol; Borneol; α-Citral; α-Curcumene; α-Zingiberene; β-Bisabolene; and β-Sesquiphellandrene. These results were illustrated in Figure 4 for 60 minutes extraction time of both methods and Figure 5 for 120 minutes extraction time of both methods. 180 minutes extraction cannot be included since there are no comparison between HD and MAHD.

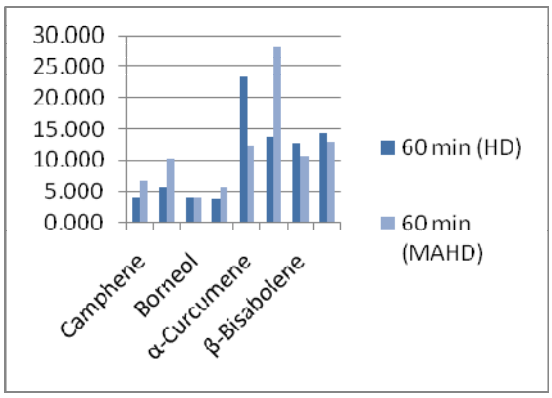


Figure 4. Chemical compositions in both methods during 60 minutes extraction time

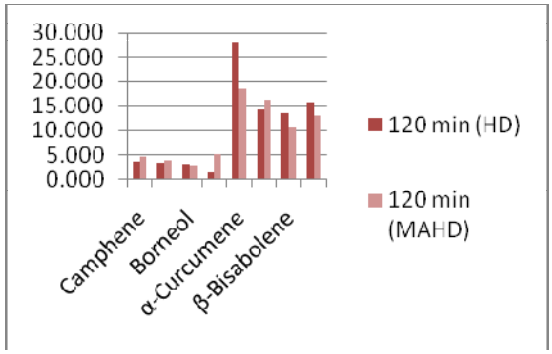


Figure 5. Chemical compositions in both methods during 120 minutes extraction time

For the 60 minutes extraction, percentage area of HD for Camphene is 4.1%, Eucalyptol is 5.61%, Borneol is 4.09%, α-Citral is 3.84%, α-Curcumene is 23.37%, α-Zingiberene is 13.73%, β-Bisabolene is 12.85% and β-Sesquiphellandrene is 14.31%. α-Curcumene was found to be main composition with 23.37%, followed by β-Sesquiphellandrene. This was different compared to MAHD event though in same extraction time (60 min) where percentage area for Camphene is 6.69%, Eucalyptol is 10.23%, Borneol is 3.95%, α-Citral is 5.6%, α-Curcumene is 12.42%, α-Zingiberene is 28.06%, β-Bisabolene is 10.72% and β-Sesquiphellandrene is 12.91%. α-Zingiberene is detected as major composition with 28.06%, followed by β-Sesquiphellandrene.

For the 120 minutes extraction, percentage area of HD

for Camphene is 3.76%, Eucalyptol is 3.43%, Borneol is 3.21%, α-Citral is 1.51%, α-Curcumene is 28.12%, α-Zingiberene is 14.2%, β-Bisabolene is 13.6% and β-Sesquiphellandrene is15.67%. α-Curcumene was found to be main composition with 28.12%, followed by β-Sesquiphellandrene. The predominant composition for 120 minu HD extraction is same as 60 min HD extraction. While for 120 min MAHD extraction, percentage area for Camphene is 4.54%, Eucalyptol is 3.9%, Borneol is 2.81%, α-Citral is 5.03%, α-Curcumene is18.53%, α-Zingiberene is 16.23%, β-Bisabolene is 10.6% and β-Sesquiphellandrene is 13.05%, α-Curcumene is traced as highest composition with 18.53%, followed by %, α-Zingiberene.

Table 2. Essential oils' composition of *Zingiber officinale Roscoe* obtained by hydrodistillation and microwave-assisted hydrodistillation

No	Chemical composition	Hydrodistillation						Microwave Assisted Hydrodistillation					
		60 min		120 min		180 min		60 min		120 min		180 min	
		RT	Area%	RT	Area%	RT	Area%	RT	Area%	RT	Area%	RT	Area %
1	1R-.alpha.-Pinene	-	-	-	-	7.652	0.85	-	-	7.652	0.99	-	-
2	Camphene	8.315	4.100	8.315	3.760	8.315	3.740	8.293	6.690	8.315	4.540	-	-
3	.beta.-Phellandrene	-	-	-	-	-	-	-	-	13.698	2.960	-	-
4	Eucalyptol	13.762	5.610	13.752	3.430	13.762	4.050	13.741	10.230	13.762	3.900	-	-
5	Borneol	21.485	4.090	21.485	3.210	21.485	2.540	21.475	3.950	21.496	2.810	-	-
6	α-Terpineol	22.874	1.920	22.863	1.470	22.874	1.220	-	-	22.874	1.260	-	-
7	β-Citral	25.213	3.840	-	-	25.214	2.120	25.203	4.600	25.235	4.190	-	-
8	α-Citral	26.666	3.840	26.666	1.510	26.677	2.610	26.666	5.600	26.698	5.030	-	-
9	β-Cubebene	-	-	-	-	-	-	36.312	2.080	36.323	2.140	-	-
10	D-Germacrene	36.323	2.010	36.323	2.100	36.333	2.580	-	-	-	-	-	-
11	α-Curcumene	36.494	23.370	36.504	28.120	36.494	13.190	36.462	12.420	36.504	18.530	-	-
12	1H-Cyclopropa(a) naphthalene	36.729	1.800	36.739	1.920	36.739	1.440	-	-	-	-	-	-
13	α-Neoclovene	-	-	-	-	-	-	-	-	36.739	1.470	-	-
14	(+)-Epi-bicyclosesqui phellandrene	-	-	-	-	-	-	36.985	2.730	-	-	-	-
15	γ-Cadinene	37.006	3.520	37.006	3.560	37.231	31.920	-	-	37.006	2.950	-	-
16	α-Zingiberene	37.177	13.730	37.177	14.200	37.231	3.070	37.177	28.060	37.199	16.230	-	-
17	β-Bisabolene	37.743	12.850	37.743	13.600	37.754	12.380	37.733	10.720	37.754	10.600	-	-
18	β-Sesquiphellandrene	38.224	14.310	38.224	15.670	38.246	13.990	38.203	12.910	38.246	13.050	-	-
19	Allo-Aromadendrene	-	-	-	-	39.228	1.180	-	-	-	-	-	-
20	.gamma.-Elemene	-	-	-	-	-	-	-	-	39.228	1.200	-	-
21	β-Farnesene	-	-	-	-	40.553	0.850	-	-	40.56	1.02	-	-
22	Cedrene	-	-	-	-	41.482	1.890	-	-	41.482	2.260	-	-
23	Di-epi-.alpha.-cedrene	-	-	-	-	-	-	-	-	42.048	0.790	-	-
24	α-Bergamotene	-	-	-	-	44.099	0.400	-	-	-	-	-	-
25	α-Cedrene	-	-	-	-	-	-	-	-	44.409	1.450	-	-
	TOTAL % AREA	**94.990**		**92.550**		**100.020**		**99.990**		**97.370**		**-**	

CONCLUSIONS

MAHD offered substantial advantages over conventional HD. A similar extraction yield was achieved at significantly shorter extraction time when using MAHD instead of HD. GC–MS results indicated that there were no significant differences between the essential oils obtained by MAHD and those obtained by HD proposing MAHD as an excellent alternative for HD with no adverse effects on the composition of the extracted essential oils. Significantly lower energy consumption with MAHD renders this technology being more environmentally friendly than HD.

ACKNOWLEDGMENTS

This research work was funded by the government of Malaysia through Fundamental Graduate Research (FGRS) grant. The authors also wish to thank individuals whom have contributed to this work.

REFERENCES

[1] H. Sutarno, E.A. Hadad, M. Brink, Zingiber officinale Roscoe. In Spices; C.C. de Guzman, *J.S. Siemonsma, Eds.; Backhuys: Leiden*, (1999) 238-244.

[2] T.A. Van Beek, M.A. Posthumus, G.P. Lelyveld, H.V.Phiet, B.T. Yen, Investigation of the essential oil of Vietnamese ginger, *Phytochemistry.* (1987) Vol. 26, No. 3005.
[3] Y. Guo, D.S. Cui, Z.M. Wang, Chin. *J. Anal. Chem. 37,* (2009) 407.
[4] B. Bayramoglu, S. Sahin, G. Sumnu, *Sep. Sci. Technol. 44,* (2009) 722
[5] M.T. Golmakani, K. Rezaei*, Food Chemistry 109* (2008)925
[6] Brachet A., Christen P., Veuthey J.L. Focused microwave-assisted extraction of cocaine and benzoylecgonine from coca leaves. *Phytochemical Analysis*, *13,* (2002) 162-169.
[7] Chemat S., Ait-Amar H., Lagha A., Esveld D.C. Microwave-assisted extraction kinetics of terpens from caraway seeds. *Chemical Engineering and Processing*, *44,* (2005) 1320-1326.
[8] E. Stahl-Biskup and Venskutonis, R.P. Handbook of herbs and spices. In K. V. Peter (Ed.). Thyme (Vol. 2, *pp. 304–328. NY, NJ: CRC Press* (2004)
[9] B. Kaufmann and Christen, P. Recent extraction techniques for natural products: microwave-assisted extraction and pressurized solvent extraction. *Phytochemistry Analysis, 13,* (2002) 105–113.
[10] M. Bendahou, Muselli A., Grignon-Dubois M., Benyoucef M., Desjobert J. M., Bernardini A. F., Costa J. Antimicrobial activity and chemical composition of Origanum glandulosum Desf. essential oil and extract obtained by microwave extraction: Comparison with hydrodistillation. *Food Chemistry, 106,* (2008) 132-139.
[11] B. Käufmann, Christen P., Veuthey J.L Parameters affecting microwave-assisted extraction of withanolids. *Phytochemical Analysis, 12,* (2001) 327-331.

Contingency Selecting of Large Electric Power System Based On Neural Networks by Radial Basis Function Method

Mohammoud.M.Hadow[1,*], Ahmed.N.Abdalla[1,2] and Sazali P. Abdul Karim3[1]
[1] University Malaysia pahang, Faculty of Electrical and Electronics Engineering, Kuantan. Gambong, 26300 kuantan, Malaysia
[2] TNB Transmission Division, Level 4, Lobby 2, Crystal Plaza, Jalan 51A / 223, 46100 Petaling Jaya, Selangor , Malaysia
* hadow50@yahoo.com, waal85@yahoo.com, sazalipk@tnb.com.my

Abstract
Contingency evaluation is one aspect of power system security assessment. Some cases in the contingency set may lead to transmission line overloads or bus voltage limited violations during power system operations .This paper present Radial basis function (RBF) Networks techniques used for contingency evaluation of large power system. Off-line Newton-Raphson load flow calculation has been adopted to construct two types of performance indexes, (active power and reactive performance index) which reflect the severity degree of contingencies. The results of off-line load flow calculation will be used to trained a radial basis function neural network (BRFNN) for estimating the predefined performance indices. The effectiveness of this technique has been demonstrated on IEEE 30–bus system. The results show the merit of using Artificial Neural Network (ANN) for contingency selection is very accurate and fast in comparison with load flow calculation for each outage of a line or generator in power system..

Keywords
Performance index; radial basis function; neural network; contingency analysis.

INTRODUCTION

Power system steady state security analysis is one of the most important issues in power system. Contingency evaluation is one aspect of power system security assessment [14]. Some cases in the contingency set may lead to transmission line overloads or bus voltage limited violations during power system operations. Such critical contingencies should be quickly identified evaluation. the process of identifying these critical contingencies is referred to as contingency selection which uses the complete AC load flow program considering outage of each line or generator, this method cannot be satisfy the real time requirements because in large system this analysis is very time consuming .Hence a variety of algorithms were developed which can be classified into two groups. One class is the performance index (PI) based method which system wide scalar PI to quantify the severity of each case by calculating their PI values, and rank them accordingly. The other class to screening method which based on approximately power flow solution to estimate those non-critical contingencies.

There are many methods for contingency evaluation of power system [1-4].most of this methods use AC load flow and mathematical calculations. Several methods for contingency screening have been developed. The widely used method to calculate the performance index is based on fast decoupled load flow program [5, 6, and 7].in modern power system due the complexity and large scale networks, contingency analysis is required powerful and fast computer. The most important point is that all possible outages may not cause overload in line and transformer, and may not cause voltage drop in different nodes of the system. Therefore is not necessary to consider all possible outages for computer simulation. For contingency analysis, it is required to specify the outages which cause the most overloads and voltage drops in the system. Such critical contingency should be quickly identified for further detailed evaluation. The process of identifying the critical contingencies is referred to contingency selection. Thus contingency selection or contingency ranking is proposed in order to rank these outages which violate the normal operating point. Contingency selection method are based on performance index (PI), that may represent line overload or bus bar voltage drop. The performance indexes are then sorted in such away to provide an ordered list of contingencies according to their severity. in the last few years, a lot of work has been done in this area which consists of the selection of the worst contingency case by using ranking method or screening methods[4]. Bounding method , distribution methods [13], expert system for contingency selection[3],neural network[11,12],and other mathematical technology used in direct calculation of MW flow violation ranking. Along the years, the efficiency of the contingency analysis method has increased significantly. The recent developments are in the speed of contingency screening using FFT and artificial neural network [2].

PROBLEM FORMULATION

For contingency selection or ranking it is requiring to computing the performance index. PLp is the active performance index corresponding to line active power violations and PLv is the reactive power index corresponding to bus voltage magnitude violations. PLp

and PLv are determined as:

$$PLp = \sum_{i=1}^{L} Wi \left[\frac{P_i}{P_{i\,max}}\right]^{2n} \quad \ldots\ldots\ldots (1)$$

Where Pi is the active power flow on line i,
Pi max is the maximum active power flow on line i,
Wi is the weight of active power flow on line i,
L is the total number online in power system, and
And n is the specified exponent (n=5 preferred) if n tends to infinity the masking error is reduced.
Plv is determined by formula as:

$$PLv(k) = \sum_{i=1}^{Npq} Wt \left[\frac{2(V_i - V_{inom})}{V_{i\,max} - V_{i\,min}}\right]^2$$

……(2)

. Where
Vi is voltage of bus I,
Vimax and Vimin are maximum and minimum voltage limits.
Vinom is average of Vimax and Vimin,
Wi is the weighting coefficient and Npq is total number of load buses in the system.
The line power flow and bus voltage magnitudes are determined by load flow calculations. PLp and Plv which have higher values are selected and need to pay further investigations.

RADIAL BASIS FUNCTION NEURAL NETWORK

Generally, RBFNN consists of three layers: the input layer, RBF layer (hidden layer) and output layer. The input of hidden layer are the linear combinations of scalar weights and input vector x=[x1, x2, x3, x4….xn] T, Where the scalar weights are usually assigned unity values. Thus the whole input vectors are appears to each neuron in the hidden node. The output layer yields a vector y=[y1,y2,y3,y4,……ym] from m outputs by linear combination of the outputs of the hidden nodes to produce the final output.Fig.1 presents the structure of asingle out put RBF network;the network output can be obtained by

$$y - f(x) - \sum_{i=1}^{K} Wi\varnothing i\,(x) \quad \ldots\ldots\ldots (3)$$

Where *f(x)* is the final output ,*Φi(x)* denotes the radial basis function of the *i-th* hidden node,*Wi* denotes the hidden to output weight corresponding to the *i-th* hidden node , and *k* is the total number of hidden nodes.

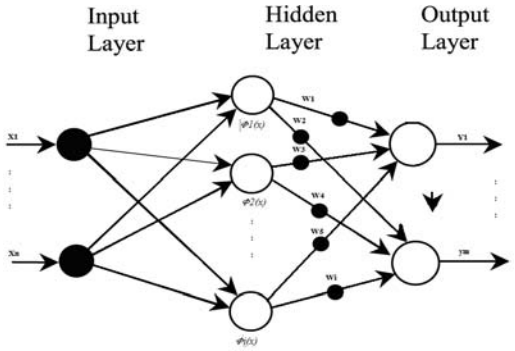


Figure1. The Structure of Radial Basis Neural Network

A radial basis function is multidimensional function that describes the distance between agiven input vector and pre-defined centre vector. There are different types of radial function .Normalized Gaussians function usually used as the radial basis function that is

$$\phi_i(x) = \exp\left(-\frac{\|x - c_j\|^2}{r_i}\right) \quad \ldots\ldots\ldots\ldots (4)$$

Where μi and Ci denotes the center and spread width of the *i-th* node,respectiviely .

PROPOSED METHODOLOGY

In this section, implementation details and performance evaluation of proposed neutral network scheme is discussed. The main step involved in implementation of proposed methodology is selection of neural network architecture and appropriate input quantities, generation of training data, and then training and testing of neural networks in the training data ,input patterns are representative of operating conditions, and output patterns are corresponding active and reactive performance index ,application of (ANN) on contingency ranking has been represented as below: The neural network architecture model in the work has been adopted to form by the input layer, middle layer and output layers

Step-1 the input layer

In this research, bus power injection are chosen as raw inputs to to the neural network. The raw in put [x] consists of power injections,(P,Q)at generator and load buses, and the value Ki which represent the outage of the line i, a sample of which is as follows:
[x]=[Vi,……Vn,Pij1……Pijl] …… (5)
Where
V: Bus Voltage
N: total number of bus
L:Total number of transmissions
Pij:line power flow

Step-2 the Middle

The choice of neurons in the middle layer is based on the experimentation and simulation, therefore no rule for selecting the number of layers.

Step -3 the output
The output vector [O] of the proposed neural network contains two elements, the first one is active performance *(PLp)* indexes and the other is reactive performance indexes *(Plv)*.
O= [PLp,PLv]……. (6)

Training
Off-line power flow results are used to construct the training set. in the present work we have used 1894 training pattern.

RESULT AND DISCUSSIONS

The proposed method is tested on the IEEE-30 Bus test system which consist of 24 PQ-type Buses, five PV-type buses, stack bus and 41 lines,[28].The neural network are designed for prediction under normal condition as well as each possible contingency. In this present work, only single outage are considered and RBFNN in order to demonstrate the use of RBFNN to calculate performance index under different demand levels and generator dispatch.
The system consists of 30 bused (6 of them are generator buses and 41 transmission lines) the line diagram of the system is shown in Fig 2.
40 load levels were used to create data for training the neural network. For example, an input pattern with line one outage as mentioned below

Y=[36.9358,-9.1729,-2.472,-1.236,-7.828,-1.648,-47.7292,4.8812,0,0,-23.484,-11.227,5.15,7.071,0,0,-5.974,-2.060,18.4679,31.3212,-11.536,-7.725,17,4173,38.5927,-6,381,-1.648,-8,446,-2,577,-3.605,-1.854,-9.27,-5.974,-3.996,-0927,-9785,-3.502,-2.266,-0.721,18.025,-11.536,0,0,-3.296,-1.648,-8.961,-6.901,0,0,-3.605,-2.369,0,0,0,0,-2.472,-0.927,-10.918,-1.957,1] …..(7)

After training, the neural network was tested using different sets of load flow cases, which were not used during the training process. Table 1 shows the value of performance in indexes PLp and PLv computed for an operating condition when one line at a time is removed in IEEE-30 Bus system outage.As shown see in table 1 , Plp and Plv from neural network is the same PLp and Plv from load flow calculation but the time to determine them is very less as compared with load flow calculations.

In this work, voltage based performance index,PLv is calculated using equation (2) as described in problem formulation section, the value of weighting exponent,n,is selected as 10 in this case.and PLp calculated using equation (1).the values of these PLp for different contingencies are calculated using estimates of ANN and the result of traditional power analysis.the contingencies are then ranked on the basis of PLp obtained using both the methods.

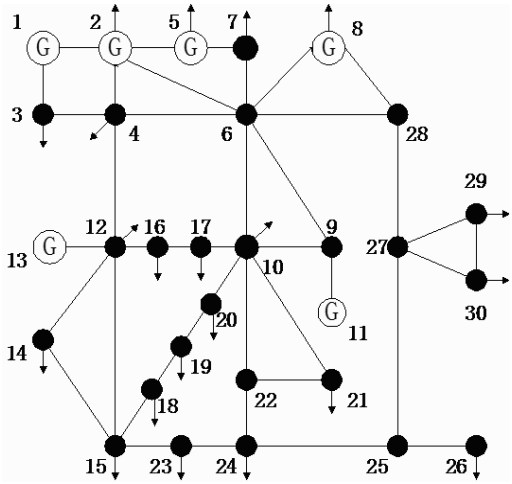


Figure 2. The single diagram of IEEE-30 Bus system

After training, the neural network was tested using different sets of load flow cases, which were not used during the training process. Table 1 shows the value of performance in indexes PLp and PLv computed for an operating condition when one line at a time is removed in IEEE-30 Bus system outage.As shown see in table 1 , Plp and Plv from neural network is the same PLp and Plv from load flow calculation but the time to determine them is very less as compared with load flow calculations.

In this work, voltage based performance index,PLv is calculated using equation (2) as described in problem formulation section, the value of weighting exponent,n,is selected as 10 in this case.and PLp calculated using equation (1).the values of these PLp for different contingencies are calculated using estimates of ANN and the result of traditional power analysis.the contingencies are then ranked on the basis of PLp obtained using both the methods.

CONCLUSIONS

This paper proposes a method for single contingency selection of large power system using Radial basis function Neural network, an approach based on radial basis function neural network (RBFNN) is developed to estimate bus voltage in Avery efficient manner for normal operation as well as for all possible single-line contingencies under changing load/generation scenario. This methodology extends for evaluation contingency ranking. Using the result off-line load flow calculation performance indices PLp and PLv are obtained which can represent the effect of severe contingency .also artificial techniques' proposed is shown very accurate and fast compared with load flow calculation for each generator or single outage of line.

Table 1. Different between ANN calculation and traditional calculation (load flow)

Contingency NO	Performance Indices active power using Load Flow	performance indices reactive power load flow	Performance Indices active power using ANN	performance indices reactive power using ANN
1	7.4549	23.4879	7.3586	23.4155
2	3.685	23.2242	3.6381	23.163
3	0.1338	22.0767	0.1321	22.0163
4	3.0472	22.693	3.0084	22.6334
5	3.3481	22.9489	3.06	22.8846
6	0.1151	22.76	0.1136	22.6992
7	0.6025	22.9316	0.5949	22.8702
8	0.064	21.3667	0.0632	21.3089
9	0.1787	20.6428	0.1767	20.5926
10	0.0522	22.5463	0.0511	22.4785
11	0.064	20.5941	0.0632	20.5375
12	0.062	22.2905	0.0612	22.2269
14	0.2755	46.6693	0.2721	46.4991
15	0.183	19.6084	0.1807	19.5548
17	0.1424	23.8917	0.1406	23.8258
18	0.1016	32.8274	0.1004	32.7238
19	0.0732	24.8015	0.07324	24.7324
20	0.0567	21.6854	0.056	216291
21	0.059	22.4931	0.0583	22.4337
22	0.0509	24.7407	0.0503	24.6727
23	0.0499	22.014	0.0493	21.9565
24	0.2511	23.447	0.248	23.3828
25	1.0261	27.3455	0.0133	27.2649
26	0.054	22.0101	0.0533	21.9522
27	0.0749	25.7282	0.0739	25.654
28	0.0892	22.4854	0.0881	22.4254
29	0.0543	21.0829	0.0536	21.0289
30	0.0582	25.8298	0.0575	25.7556
31	0.0611	23.9504	0.0604	23.8824
32	0.0519	22.2795	0.0513	22.2204
33	0.0533	20.1413	0.0526	20.0921
35	0.0162	28.517	0.004	28.4368
36	4.7508	52.7472	4.6902	52.4473
37	0.3299	27.7166	0.3258	28.6325
38	0.3857	27.489	0.3809	27.4047
39	0.0839	22.2095	0.0829	22.1504
40	0.0564	22.7934	0.0557	22.7314
41	0.0566	25.2404	0.0559	25.1711

ACKNOWLEDGEMENTS

The work reported in this paper was fully supported by University Malaysia Pahang for Research and Development (Grant No. GRS0090125).

REFERENCES

[1] Mohammad khazaei,shahram Jadid"contingency Ranking using Nerural Networks by Radial basis fuction Method"*IEEE Transcation on power system (2008)*

[2] K.Lo & L.J peng &J.MACQEEN"Fast Real Power Cintngency Ranking Using Acounterpropogation"*IEEE Transaction on power system ,Vol.13,NO.4,November 1998*.

[3] shahram Jadid & M.Rokni"Expert System To Improve Power System Contingency Analysis"*Electrical power research 40(1997)pp.37-43*

[4] J.Sobajic,Y.H.Pao,"An Artificial intelligence system for power system contingency screening "*,IEEE Trans.power syst.3(1998)647-653.*

[5] H.Mori et al"Apresconditional Fast Decoupled Power Flow Method For Contingency Screening"*IEEE Transactions on power system.Vol.11,pp.357-363,feb 1996*

[6] Stott B, Alsac O. Fast decoupled load flow. *IEEE Trans Power Apparatus Syst 1974;PAS-93:859–69.*

[7] S.Ghosh,B.H.chowdhury,design of an atifitial neutural network for fast line flow contingency ranking,*Elec.power Energy syst.18(1996)271-277*

[8] L.Srivastava, S.N.Singh, J.sharam,"parallel self-organizing hierarchical neural network-based estimation of degree of voltage insecurity, *Int.J.Comput.Elec.Eng.29 (2003)589-602.*

[9] P.K.Kalra,A,Srivastava,D.K.Chaturvedi.Possibl e applications of neural nets to power system operation and control.Elec.*Power system research.25(1992)83-90.*

[10] M.Pandit,L.Srivastava,J.Sharma,Cascade fuzzy neural network based voltage contingency screening and ranking,*Elec.Power syst.Res.67(2003)143-152*

[11] Y.Y.Hsu,H.C.Kuo.Fuzzy set based contingency ranking,*IEEE Trans.power syst.7(1992) 1189-1195*

[12] S.Ghosh,B.H.chowdhury,design of an atifitial neutural network for fast line flow contingency ranking,*Elec.power Energy syst.18(1996)271-277*

[13] Shant K..Avakian,Afaneen Anwar,Ahmed .N.Abdalla"the application of agent technology on the power flow of Iraqi supper grid network"*,American journal of applied sciences 3(12:2174-2177,2006*

[14] Srivani J, Swarup KS. Power system static security assessment and evaluation using external system equivalents system equivalents. *Electr Power Energy Syst 2008;30:83–92.*

Speed Estimation Induction Motor Based Artificial Neural Fuzzy

Solly Aryza, Ahmed N Abdallah, Zulkeflee bin Khalidin, Zulkarnain Lubis
Faculty Electrical Engineering, University Malaysia Pahang, Pekan 26600, Pahang, Malaysia
e-mail: sollyaryzalubis@gmail.com ahmed@ump.edu.my, zulkeflee@ump.edu.my, zl99.alex@gmail.com

Abstract
This paper relates an adaptive speed control of Simulation Neural Fuzzy high-performance induction motor drives. Speed control performance of induction motors are affected by parameter variations and non linearity in the induction motor. Speed estimation method for control of induction machine drive has gained increasing interest among the research communities. The supremacy of an induction machine drive depends on the speed estimation accuracy. To ensure accurate speed estimation over a wide range, from zero to high levels exceeding the rated speed, accurate values of the machine's parameters, the aim of the simulation proposed control is to improve the performance and robustness of the induction motor drives under non linear loads and parameter variations. Both the design of the fuzzy controller and its integration with neural network in a global control system are discussed. Simulation results shown excellent tracking performance of the proposed control system, and have convincingly demonstrated the usefulness of the neural fuzzy controller in high performance drives with uncertainly.

Keyword
Neural fuzzy, speed control, induction motor

INTRODUCTION

Three phase induction motor is, devices widely used in the industrial world. Induction motor has several parameters that are non-linear, especially the rotor resistance, whose value varies for different operating conditions. This cause the settings on the induction motor is more complex than AC motors. Solution induction motor control has the features of precise and quick torque response. In the mid eighties have been recognized to be a viable solution to achieve these requirements [1],[3],[7],[9], [11],[17].In the neural fuzzy scheme [1] (Fig. 3), the electromagnetic torque and flux signals are delivered to two hysteresis comparators.

The corresponding output variables and the stator flux position sector are used to select the appropriate voltage vector from a switching table which generates pulses to control the power switches in the inverter [2]. This scheme presents many disadvantages (variable switching frequency - violence of polarity consistency rules - current and torque distortion caused by sector changes - start and low-speed operation problems - high sampling frequency needed for digital implementation of hysteresis comparators) [8], [11], [13,[15], [17]. To eliminate the above difficulties, Neural Fuzzy Control scheme (NFCS) has been proposed [17]. This scheme uses a controller based on an adaptive NF inference system [5], [6], [10] together with a space voltage modulator to replace both the hysteresis comparators and the switching table.

The Adaptive NF inference system controller combines fuzzy logic and artificial neural networks to evaluate the reference voltage required to drive the flux and torque to the demanded values within a fixed time period[4]. This evaluation is per- formed using the electromagnetic torque and stator flux magnitude errors together with the stator flux angle. This calculated voltage is then synthesis using Space Vector Modulation (SVM). To generate the desired reference voltage using this scheme, the Adaptive NF inference system controller acts only on the amplitude. A proposed modification of this scheme is to design a Adaptive NF inference system controller to act on both the amplitude and the angle of the reference voltage components. All the schemes cited above use a PI controller for speed control. The use of PI controllers to command a high performance directs torque controlled induction motor drive is often characteristic by an overshoot during start up.

This is mainly caused by the fact that the high value of the PI gains needed for rapid load disturbance rejection generates a positive high torque error [12]. This will let the DTC scheme take control of the motor speed driving it to a value corresponding to the reference stator flux. At start up, the PI controller acts only on the error torque value by driving it to the zero borders. When this border is crossed, the PI controller takes control of the motor speed and drives it to the reference value. To overcome this problem, we propose the use of a variable gains PI controller (VGPI) [14]. A VGPI controller is a generalization of a classical PI controller where the proportional and integrator gains vary along a tuning curve. In this paper, a variable gain PI controller is used to replace the classical PI controller in the speed control of a modified direct torque neural fuzzy controlled induction machine drive where the ANFIS of the DTNFC acts on both the amplitude and the angle of space vector components [16].

Proposed Neuro Fuzzy Controller

Control signals used for induction motor drives (U (k)) is

U (k) = Uneural + Ufuzzy (1)

The output of the reference model state output desired from a plant which is controlled if the system to get the settings right. In determining the relative degree of model reference, reference model together with the plant. Dynamics input-output of the reference model give with second-order mode.

$\omega r\,(k+1)$ =alωr(k)+a2ωr(k-1)+r(k) (2)

$\omega r\,(k+1)$ =0.48ωr(k)+0.25ωr(k-1)+r(k) (3)

$\omega r\,(k+1)$ = output signal mode reference

r(k) = input mode reference

Block diagram of the controller design on this study is shown in Figure 1.

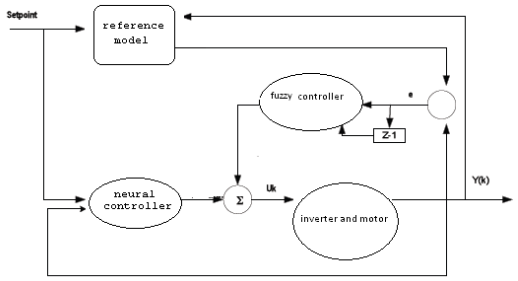


Figure 1: diagram block controller

Figure2. Structure controller neural network

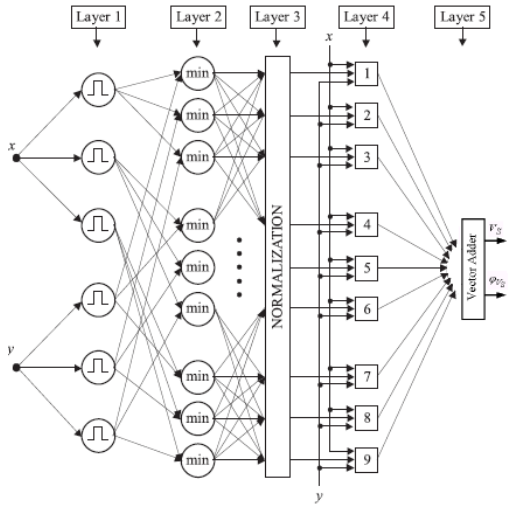
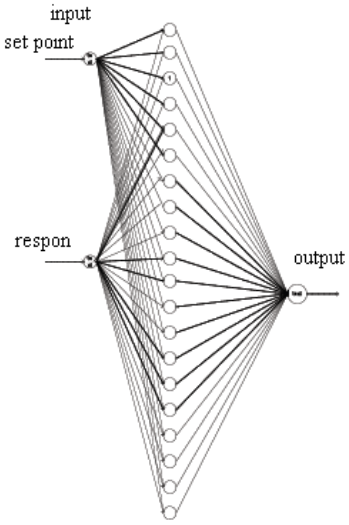


Figure3. Neural Fuzzy structure controller

Neural network controllers are designed using Multilayer Perception Neural network error Back propagation type. Neural network structure used in as shown in Figure 3. Network has the two layers namely the output of the set point input and output of the system response, a single layer as output control signals and one or more hidden layers. The number of layers, which are used as much as two layers by using two types of neurons, is 20 neurons and 50 neurons. Activation function used for input and hidden layer is sigmoid logarithmic whereas the output neurons use linear activation functions



Parameter Of Induction Motor In Neural Fuzzy

A method of using neural fuzzy to interpret current of induction motor for its stator condition monitoring was presented. Correctly processing theses current signals and inputting them to a neural fuzzy decision system achieved high diagnosis accuracy. There is most likely still room for improvement by using an intelligent means of optimization. We can see parameter the induction motor in table 1.

Table 1. Parameter Of Induction Motor

Rated Parameters of the Induction Motor Under Test		
Rated Values	Power	4 kW
	Frequency	50 Hz
	Voltage	220/380 V
	Current	15/8.6 A
	Speed	1440 rpm
	Pole Pair	2
	Resistance stator (Rs)	7.13 ohm
	Resistance rotor (Rr)	8.18 ohm
	Reactance stator	9.45 ohm
	Reactance rotor	9.45 ohm
	Reactance together	189.65 h m

Result Of Experimental Simulation

Simulations made using Simulink and m-file from MATLAB 7. Based on the results modeling of an induction motor with the dq model has done so for the model simulation induction motor in Simulink as shown in Figure 3. Motor parameters obtained from the measurement of induction motor carried out into MATLAB with the induction using m-files.

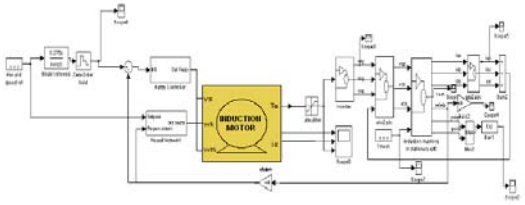


Figure.4. Control Induction Motor Based Neural Fuzzy

In this simulation scenario the Induction motor follow parameter from that motor. The estimated values of direct rotor flux and load torque also track their measured values more closely throughout the operation range.

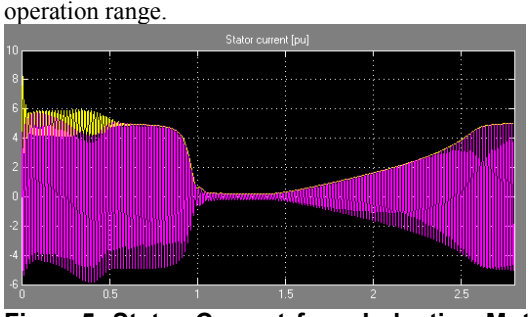


Figure5. Stator Current from Induction Motor Based Neural Fuzzy

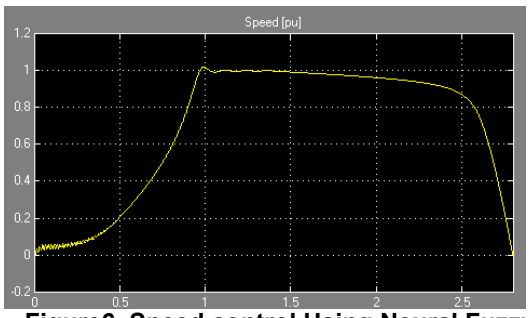


Figure6. Speed control Using Neural Fuzzy

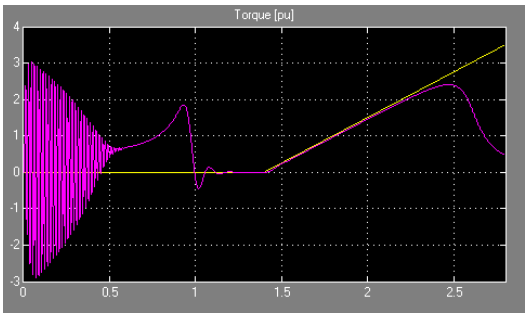


Figure7. Torque from Performance Induction Motor

In the Figure 5, 6, and 7, showed the stator current, speed, and torque currents of induction motors using system Neural Fuzzy, where everything is quite stable when compared to using other systems.

CONCLUSION

Based on the results of simulation and analysis of induction motor speed control system in a centrifugal machine using neural fuzzy controller, it can be concluded:

a. In the simulation of fuzzy neural controller without the expense that generated the response speed depends on the number of neurons used.
b. At no-load conditions, controller with 50 neurons produce the most rapid settling time that is equal to 2.48 seconds, while the steady state error by using the smallest controller with 20 neurons by 0.3%. Application of neural fuzzy controller does not cause the maximum overshoot in the system.
c. In the simulation of neural fuzzy controller by providing the load change to maintain exact speed controller set point. In the controller 50 neurons have faster recovery time with the smallest steady state error of 0.13%.

REFERENCE

1. Miloudi,A,A1 radadi, E.A Draou. "A Variable Gain PI Controller Used for Speed Control of a Direct Torque Neuro Fuzzy Controlled Induction Machine Drive", Turkish Journal of Electrical Engineering 15 No. 1 (2007).
[2] 2. A. Miloudi, E. A. Al Radadi, A. Draou, Y. Miloud " Speed Control of a Simplified Direct Torque Neuro Fuzzy Controlled Induction Machine Drive Using a Variable Gain PI Controller ", *Conf. Rec. STCEX2006*, Riyadh, Saudi Arabia, December 02-06, 2006.
[3] 3. M. Zerikat, M. Bendjebbar and N. Benouzza." Dynamic Fuzzy-Neural Network Controller for Induction Motor Drive" World Academy of Science, Engineering and Technology 10 2005.
[4] B.P. McGrath, D.G. Holmes and T. Meynard, **"**Reduced PWM Harmonic Distortion for Multilevel Inverters Operating Over a Wide Modulation Range" *IEEE Transactions on Power Electronics*, Volume 21, Issue 4, July 2006, pp. 941 - 949.
[5] Rajesh Kumar, R. A. Gupta, 3Rajesh S. Surjuse "A Vector Controlled Induction Motor Drive With Neural Nethwork Based Space Vector Pulse Width Modulator"" Journal of Theoretical and Applied Information Technology © 2005 - 2008 JATIT. All rights reserved.
[6] A. Miloudi, E.A.A Radadi, A. Draou and Y. Miloud, "Simulation and modeling of a variable gain PI controller for speed control of a direct torque neuro fuzzy controlled induction machine drive," in the Proc. of IEEE PESC 2004 Conf., Vol. 5, 20-25 June 2004, pp. 3493–3498.
[7] M. N. Uddin and H. Wen "Development of a self-tuned neuro-fuzzy controller for induction motor drives," in Conf. record of Industry

Applications 2004, Vol. 4, 3-7 Oct. 2004, pp. 2630–2636.

[8] P. P. Cruz, J. M. Aquino and M. R. Elizondo, "Vector control using ANFIS controller with space vector modulation [induction motor drive application]," in the Proc. of UPEC Conf., Vol. 2, 6-8 Sept. 2004, pp. 545–549.

[9] S. Kaboli, M. R. Zolghadri, E. Vahdati-Khajeh," A Fast Flux Search Controller for DTC-Based Induction Motor Drives", *Industrial Electronics, IEEE Trans.* on Volume 54, Oct. 2007 Page(s):2407 – 2416.

[10] S. Kaboli, M. R. Zolghadri, E. Vahdati-khajeh, A. Homaifar, "A Fast Optimal Flux Search Controller with Improved Steady State Behavior for DTC Based Induction Motor Drives", in Proc. International Electrical Machines and Drives Conference, 2005.

[11] S. Kaboli, M. R. Zolghadri, E. Vahdati-khajeh, A. Homaifar ,"on the Performance of Optimal Flux Search Controller for DTC Based Induction Motor Drives", Electric Machines and Drives, 2005 IEEE International Conference on 15-18 May 2005 Page(s):1752 – 1756.

[12] 12. Abolfazl Vahedi, Farzan Rashidi "Sensorless Speed Control of Induction Motor Derives Using a Robust and Adaptive Neuro-Fuzzy Based Intelligent Controller

[13] M.L. Benloucif, and L. Mehenaoui, "A fuzzy neural scheme for fault diagnosis," Proc. International Computer Systems and Information Technology Conference ICSIT'05, Algiers, July 19-21, 2005.

[14] M.L. Benloucif, and H. Balaska, "Robust fault detection for an induction machine," 7th World Automation Congress- WAC 2006, Budapest, Hungary, July 24-26, 2006.

[15] Mohamed-Lamine Benloucif," Neuro-Fuzzy Sensor Fault Diagnosis of an Induction Motor", International Conference On Communication Computer And Power (ICCCP'09) MUSCAT, FEBRUARY 15-18, 2009

[16] M. N. Uddin and Hao Wen, "A Neuro-fuzzy Based Hybrid Intelligent Controller for High Performance Induction Motor Drives", IEEE IAS Conf. Record, Seattle, USA, 2004, pp. 2630-2636.

[17] M. Nasir Uddin, Hao Wen" Model Reference Adaptive Flux Observer Based Neuro-Fuzzy Controller for Induction Motor Drive" 0-7803-9208-6/05/$20.00 © 2005 IEEE

Authigenic Clay Minerals in Sandstone unit of Sandakan Formation, Sandakan Peninsular, Sabah

Fauziah Hanis Hood[1.1] and Sanudin Hj. Tahir[1,2]
[1]Programme Geology Programme, School of Science and Technology, University Malaysia of Sabah, 88999 Kota Kinabalu, Sabah.
[1,1]fauziahhanis@yahoo.com, [1,2]tsanudin@ums.edu.my

Abstract
The sandstone units of Sandakan Formation were deposited in Neogene basin during Late Miocene to Pliocene. The authigenic clay mineral and diagenesis history of sandstone unit of Sandakan Formation were determined and interpreted from SEM image. Both channelized sandstone sample consists of kaolinite, illite and smectite, formed as cement, grain coat and pore filling. Both samples have shown abundant pore even though with the presence of clay mineral in the sandstone. Sandakan Formation is buried in a fluvial system to shallow marine environment. Thus, proved the sandstone have undergone a shallow diagenesis by the presence of authigenic kaolinite and illite. The eogenetic alteration in sandstone represented by kaolinization of framework feldspar, which induced by meteoric water reflux in fluvial environment. Illite is formed by the reaction of kaolinite with K- feldspar in increasing depth and temperature during mesodiagenesis.

Keywords
Authigenic clay mineral, eogenetic alteration and mesodiagenesis

INTRODUCTION

The research area is located at Sandakan Peninsular. The research area was included Pulau Berhala, and Sandakan town with more than 100 km^2 wide. Sandakan is located at the east Sabah, respectively eastern part of Borneo Island. The peninsular is facing eastward to the Sulu Sea and beyond the Palawan Island. Both fresh rock samples were collected from Jalan Lintas Utara (JLU) and Jalan Jaya Chip (JJC), respectively in the northeast and southwest of the peninsular.

GEOLOGICAL SETTING: STRATIGRAPHY FRAMEWORK

Sandakan Formation is a part of Neogene basin in east Sabah. This circular basin deposited in Late Miocene after the end of Cagayan Ridge volcanic arc into east Sabah (Middle Miocene event (Rangin et. al, 1990). The Sandakan Formation overlain mélange unit (Garinono Formation), which represents as a part of major mélange unit in east Sabah.

Generally, Sandakan Formation is developed by two main lithofacies; sandstone and mudstone unit (Ujié, 1970; Hutchison 2005). Noad & Harbury (1997) were constructing the stratigraphy framework of Sandakan Formation and divided the lithofacies unit into seven units:

- Channelized sandstone
- Cross bedded sandstone
- Interbedded sandstone
- Heterolithic
- Thin bedded mudstone
- Thick grey mudstone
- Carbonaceous mudstone

The presence of some agglutinated planktonic foraminiferas including *Globoquadrina altispira altispira*, *Globorotalia sp., G. fohsi fohsi, Orbulina suturalis and Globigerina sp.* (Ujié, 1970 & Hutchison, 2005) indicates the age of Sandakan Formation basin deposition occurred during Late Miocene to Pliocene (Sanudin Tahir & Baba Musta, 2007). Noad and Harbury (1997) modeled a of stratigraphy framework with detailed sedimentological data. Sandakan Formation is interpreted as a fluvio – deltaic to shallow marine environment.

METHODOLOGY

The selected channelized sandstone unit samples were collected from Jalan Lintas Utara (S1JJC) and Jalan Jaya Chip (S4JLU) outcrop. The samples were prepared for SEM analysis by removing fractured fragment from the sample measuring less than 1 cm diameter. JEOL *JSM 5610* Scanning Electron Microscope is used to analyzed the sample.

RESULT

The authigenic clay minerals in channelized sandstone of the Sandakan Formation mainly consist of kaolinite with lesser amount of illite-smectite. The adjacent quartz detrital is cemented by kaolinite, later diagenetic illite; reduce the pore size as well (Figure 2.0). Some of the quartz detrital is coated by honey comb illite and kaolinite (Figure 2.1).

Figure 2.2 and 2.3 represented the fairly to good porosity. The quartz detrital is not cemented well (figure 2.2) and remained more pores than S1/JJC sandstone (Figure 2.0). While in figure 2.3, the pore throat still can be observed between illite – smectite and kaolinite features.

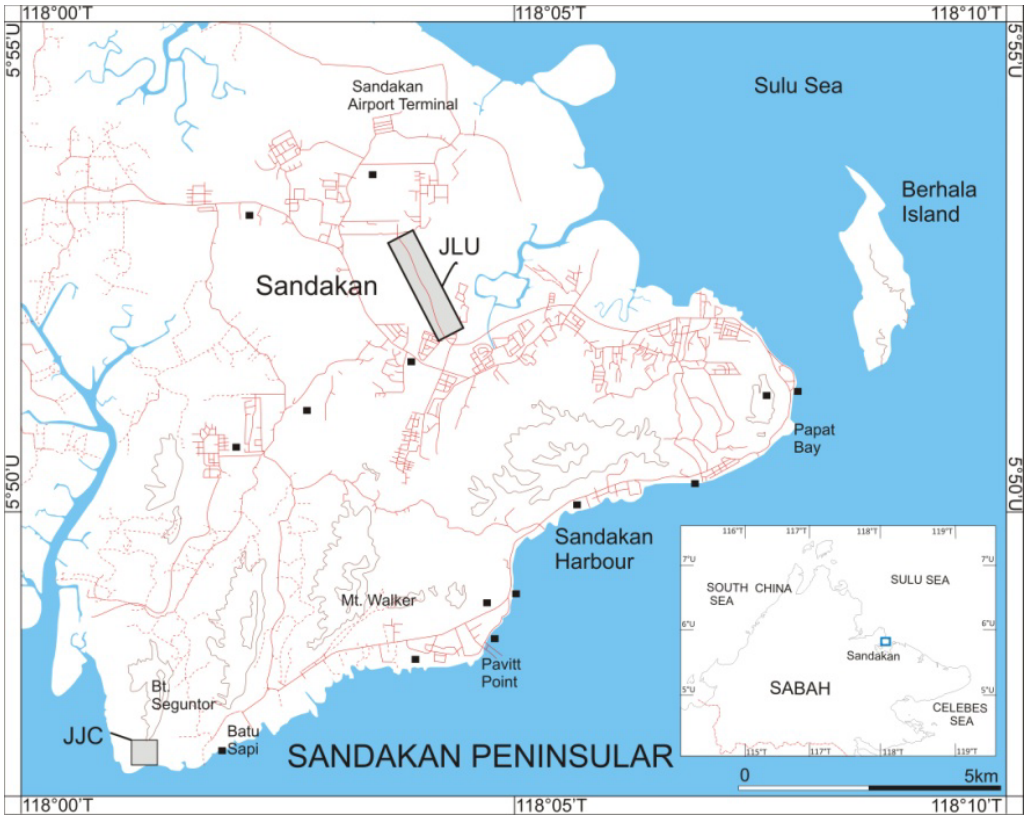


Figure 1.0. The site of sample collected in Sandakan Peninsular area.

DISSCUSION

Channelized sandstone unit had undergone two phase of diagenesis process. The first phase involves eogenetic alteration of framework feldspar into kaolinization, followed by mesodiagenetic process of illite formation on a deeper depth.

Eogenetic alteration: kaolinite alteration

The first phase occurred during early diagenesis in shallow environment which only a few metres underneath the surface. Franks & Zwingmann (2010) suggest the original feldspar have altered to kaolinite. Limited supply of k – feldspar illite formation in the k – feldspar limited area may be at least partly due to the kaolinization of k – feldspar during early weathering and meteoric water influx near basin margin.

Mesodiagenesis: Meteroic water flux effect on illite formation

Fresh water dissolves feldspars to create a (Ajdukiewicz et al., 2010) reaction between kaolinite and remnant k – feldspar, induced by the later high temperature formed diagenetic illite (refer Figure 3.0.).

Sandstone diagenesis occurred in equilibrium/ near equilibrium assemblage of either illite – k – feldspar or illite- kaolinite depends on the lesser reactant have been consumed, regards to increasing depth and temperature (Franks & Zwingmann, 2010).

Paragenesis of authigenic clay mineral

According to Table 1.0., quartz detrital, feldspar and other sandstone detrital is formed during magmatism partial melting (pre - diagenesis) to form rock mineral in parent rock. Thus, the detrital grains have undergone transportation, reworked and deposition. Cementation occurred along diagenesis, from the earlier phase, continued with increasing temperature and pressure (mesodiagenesis). Reaction of dissolution feldspar with meteoric water flux formed kaolinite, later altered to illite (Ajdukiewicz et al., 2010; Franks & Zwingmann, 2010).

Table 1.0. Sandakan Formation sandstone unit undergone pre, early and later phase diagenesis.

Formation	Diagenetic phase		
	Pre - diagenesis	Eogenesis	Mesogenesis
quartz detrital	———		- ———
feldspar	———		
cement		———	———
kaolinite		———	
illite			———

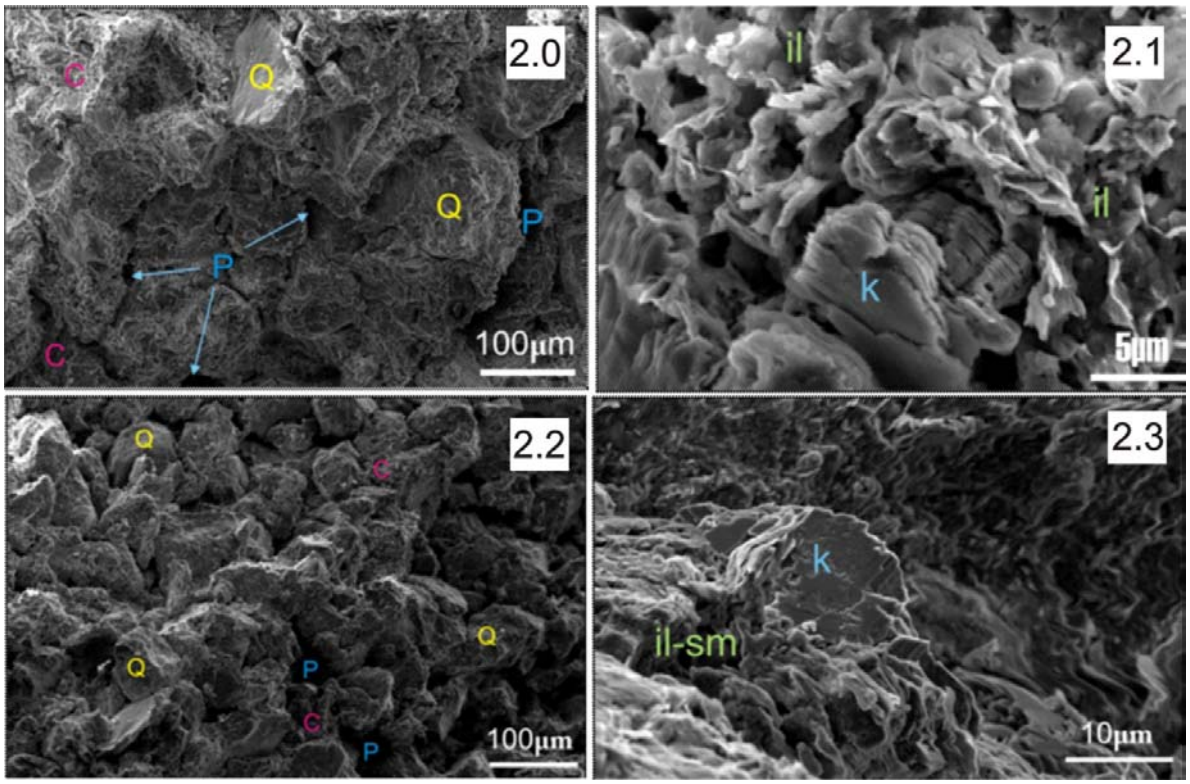


Figure 2.0. & 2.1. S1/JJC medium grained sandstone. Illite present as a honey comb – liked. il - Illite and k – kaolinite. Figure 2.2. & 2.3. S4/JLU fine grained sandstone. The subhedral quartz is slightly cemented. Pore throat quite abundant in the image and pore lining- kaolinite altogether with illite – smectite. Quartz crystal face coated by illite – smectite). Both sample shown an illization on kaolinite.

Mesodiagenesis: illite forming reaction

$Al_2Si_2O_5(OH)_4 + KAlSi_3O_8 \rightarrow KAl_3Si_3O_{10}(OH)_2 + 2SiO_2 + H_2O$

kaolinite k - feldspar illite quartz

Figure 3.0. Chemical reaction of kaolinite with dissolution k – feldspar with intrusion of meteoric water flux during diagenesis. Modified from Franks & Zwingmann (2010)

Effects on reservoir quality and heterogeneity

The eogenetic alteration in fluvial, tidal and deltaic sandstone facies can be estimated by the abundance of feldspar and effective meteoric water flux in dissolution and kaolinization of framework feldspar. The alteration impacts on reservoir quality by formation of intergranular and moldic pores.

Mesodiagenetic process in sandstone controlled the availability of precursor clay minerals (kaolinite and smectite). This impact the permeability deterioration, increase in water saturation and also enhance of intergranular pressure dissolution. The precipitation of kaolinite in intergranular pores enhanced intergranular secondary porosity and limited permeability reduction (Morad et. al, 2010).

CONCLUSION

Channelized sandstone unit of Sandakan Formation is believed have undergone the shallow depth burial during two phases of diagenesis in a fluvial to shallow marine environment.

The factors affect the diagenetic evolution near surface are (1) Grain dissolution; the feldspar, rock fragments, mud intraclasts and heavy minerals. (2) Formation of pore lining minerals including smectite, iron oxide and Fe- rich clays. (3) Formation of grain – replacing kaolinite and smectite. The diagenetic alteration on continental sandstone, for fluvial deposit respectively, is favored by unstable silicate dissolution and kaolinite formation under humid condition (Morad et. al, 2010). Furthermore, this explains on how authigenic clay mineral formed in Sandakan

Formation at fluvial environment in Equator.

The SEM image would have been supported by other data later, such as thin section and XRD analysis to improve diagenesis and authigenic mineral identification of sandstone unit in Sandakan Formation.

ACKNOWLEDGMENTS

The author is grateful to her research colleague and supervisor for great discussion, support in the field and various occasions.

REFERENCES

[1] Ajdukiewicz, J. M., Nicholson, P. H. & Esch, W. L. *Prediction of deep reservoir quality using early diagenetic process models in the Jurassic Norphlet Formation, Gulf of Mexico. AAPG Bulletin,* 94: 8 (2010) 1189–1227.

[2] Franks, S. G. & Zwingmann, H. *Origin and timing of late diagenetic illite in the Permian–Carboniferous Unayzah sandstone reservoirs of Saudi Arabia. AAPG Bulletin,* 94:8 (2010) 1133–1159.

[3] Hutchison, C. *Tanjung Circular Basin. In Geology of North-West Borneo.* Elsevier. (2005) 277-303.

[4] Morad, S. Khalid Al-Ramadan, J. M. Ketzer, J. M. & De Ros, L. F. *The impact of diagenesis on the heterogeneity of sandstone reservoirs: A review of the role of depositional facies and sequence stratigraphy. AAPG Bulletin,* 94: 8 (2010) 1267–1309.

[5] Noad, J. & Harbury, N. *The Sedimentology of Miocene shallow marine clastic of the Sandakan Formation of Eastern Sabah. Geol. Soc. Malaysia Bulletin.* 40 (1997) 119-133.

[6] Rangin, C., Bellon, H., Benard, F. Letouzey, J., Muller, C. & Sanudin Tahir. 1990. *Neogen – arc continent collision Sabah, Northern Borneo (Malaysia)*. In Angelier, J. (Editor), *Geodyanmic Evolution of the Eurasian Margin, Tectonophysics*, 183 (1990) 305 – 319.

[7] Sanudin Tahir & Baba Musta. *Pengenalan Kepada Stratigrafi Sabah*. Kota Kinabalu: Penerbit UMS. (2007)

[8] Ujié, H. 1970. *Miocene Foraminiferal Faunas from the Sandakan Formation, North Borneo.* Kobayashi, T. & Toriyama, R. (eds.). *In Geology & Paleontology of South East Asia.* Tokyo: University of Tokyo Press. 8 (1970) 55-183.

Compressive Strength of Lime Stabilized Clayey Soil from Kundasang, Sabah

Nur Fatinidiana Ramlee[1,*], Baba Musta[1,2]
[1]Geology Programme, School of Science and Technology, Universiti Malaysia Sabah,
Locked Bag 2073, 88999 Kota Kinabalu, Sabah, Malaysia
*tini_1201@yahoo.com

Abstract
This paper discusses the compressive strength of clay soil stabilized with lime. Soil samples were collected from the weathered rock of Trusmadi Formation at road cuts and construction site in Kundasang, Sabah. The soil samples classified as clayey sandy silt with gray in colour. The different percentage of lime i.e 0%,2%,4%, 8% and 16% were mixed into the soil samples before cured for 0, 7, 14, 21 and 28 days. The compressive strength of soil stabilized with different percentage of lime and different age were observed. As conclusion, the optimum lime content was 2% and 28 days curing period.

Keywords
Lime stabilization, clayey soil, compressive strength.

INTRODUCTION

The lime treatment techniques have been used for many years and have been developed across the world (Bell, 1996). Cementitious binders through lime stabilizations is widely used in road, pavement and foundation construction (Oti.*et.al*. 2009). The increase in the shear strength and bearing capacity of the soil also depends on the formation of cementitious minerals due to the reaction between lime and the clay minerals (Bell,1996). When the lime has been added into clay soils, it will interferences the physico-chemical properties of clay soils due to the cation exchanges process between Ca^{2+} from the lime with the $Al^{3+,}$ Si^{4+} from the clay (Bell, 1996). Bozbey & Garaisayev (2009), suggested that the mechanical properties of lime-stabilization specimens with different quantities of lime will increase the unconfined compression test and increased the soil strain. The reaction of lime and clays soils will form flocculation of Calcium Aluminates Silicate Hydrate (CASH). The CASH will changes to Calcium Silicate Hydrate (CSH) and Calcium Aluminates Hydrate (CAH) (Bell, F.G., 1996; Rajasekaran. G., *et.al*. 1997; Al-Mukhtar. M., *et.al*. 2010). The different percentage
of lime i.e 0%,2%,4%,8% and 16% with different curing time were reported from previous researcher (Fong.,*et.al*. 2006 and Bell, 1996).

METHODOLOGY

Materials

The clayey soil samples were collected from the road-cut and construction site in Kundasang area (Figure 1). The soil samples were originated from metasediment which is interbedded of sandstone and gray shale (Jacobson, 1970). The Trusmadi Formation is predominantly argillaceous rocks with middle to lower Eocene age. The formation comprises strongly folded and faulted alternating bands of siltstones, mudstones and shales in which the generally thinly bedded siltstones are subordinate to the more massive mudstones. Figure 2 shows the occurrences of road subsidence in the study area.

Figure 1. Sampling station showing the clayey soil from the weathered rock of Trusmadi Formation.

The result of particle size analysis shows the soil is consist of 19.5% clay, 40% silt and 40.54% sand Figure 3 shows the particle size distribution of soil samples. The physico-chemical properties of soil are shown in Table 1.

The hydrated lime were bought from the local company in Inanam, Sabah. The chemical composition of hydrated lime are given in Table 2. The data shows that the concentration of CaO is 63.31%, whereas the LOI is 30.07%. The others elements are lower than 5%. The Figure 3 shows the pattern of curve for particle size distribution analysis which is well graded sorting of the soil sample.

Table 1. The physico-chemical of Trusmadi Formation soil in Kundasang area

Physico-Chemical properties	Value
Clay (%)	19.50
Silt (%)	40.00
Sand (%)	40.54
Moisture Content (%)	17.92
Specific Gravity	2.61
Liquid Limit (%)	25.24
Plastic Limit (%)	17.81
Plasticity Index (%)	10.29
Shrinkage Limit (%)	8.511
Optimum moisture content w_{opt} (%)	10.5
Maximum dry density (Mg/m^3)	2.16
Unconfined Compressive Strength (kPa)	99
Permeability (m/s)	6.02×10^{-9}
pH	8.72

*USCS:Unconfined Soil Classification System

Figure 2. The landslide movement on road cut slope.

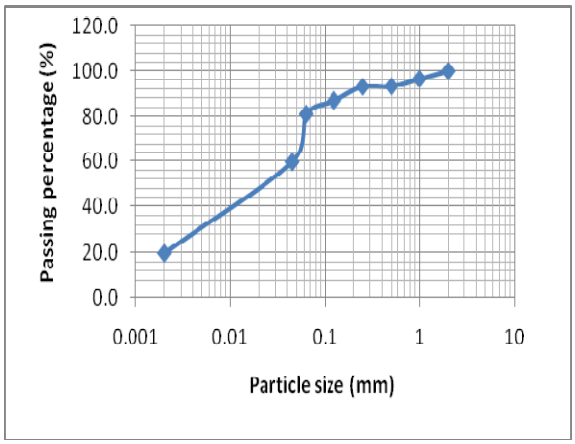


Figure 3. Particle size distribution of Trusmadi Formation's soil.

Table 2. The compostion of major elements in hydrated lime.

Major Elements	Concentration (%)
SiO_2	1.49
Al_2O_3	0.52
MnO	0.023
MgO	1.637
CaO	63.31
TiO_2	0.038
Na_2O	0.02
K_2O	0.048
P_2O_5	0.031
Fe_2O_3	0.33
L.O.I	30.07
TOTAL	**97.5067**

*L.O.I: :Loss On Ignition

Unconfined Compressive Strength Test

The unconfined compressive strength tests (UCT) were used to determine the strength of unstabilized and stabilized soil sample's (ASTM,1992). The calculation of the maximum dry density and optimum moisture content were obtained from the compaction curve of unstabilised soil samples (Kalkan.,*et.al*. 2004; Horpibulsuk.*et.al* 2010). The unstabilized soil specimens were mixed homogeneous with different percentage of lime. A cylinder specimen were prepared 50 mm in diameter and 100 mm in height. Then, the specimens were covered by aluminum foil and have been cured between 0 until 28 days under the room temperature (Little, 1995; Cuisinier.*et.al.* 2009). A minimum of tree specimens was prepared for each combination of variables for compressive test. A compression test was carried out after a curing time.

RESULT AND DISCUSSION

Compressive Strength and percentage of lime

The results of compressive strength test of soil stabilized with different percentages of lime are shown in Figure 4. It shows that all stabilized soil sample has higher strength compare to the unstabilized samples. The optimum value of Unconfined Compressive Strength is addition with 2% of lime where the value is 499 kPa. The compressive strength is slightly decreased with addition 4% of lime and maintained the value until 16% of lime. The fluctuated of soil strength is affected by the cohesion and internal friction of lime particles and chemical reactions between lime and clay materials (Kalkan *et. al,* 2004). The increasing of lime additional in clays made the samples more brittle and though fractures in the composite samples. Furthermore, the change in strength is

related to particle reorientation and moisture distribution (Okyay.*et.al*. 2010).

Compressive Strength and curing period

The relationship between the curing periods of lime stabilization with the compressive strength is illustrated in Figure 5. It is shown that an average, the optimum strength for all stabilized soil is 7 days curing period. However, the maximum strength achieved aftor 28 days for sample stabilized with 2% of lime. Horpibulsuk *.et.al* (2010) suggested that the pore size distribution of the stabilized samples shown that during 7 days of curing, the cementitious products fill pores smaller than 0.1 µm and the coarse particles (unhydrated cement particles) will cause the large soil-cement and large pore space. According to the Horpibulsuk *.et.al* (2010), after the 7 days curing, the volume of pores larger than 0.1 µm is tends to decrease the volume of the pore rather the 0.1 µm is tends to increase possibly because the cementitious products filling the large pores. The storage conditions in this study such as temperature, hygrometer, moisture content or perturbation is maintained during curing time. The changes in the storage conditions will affect the unconfined compressive strength of soils (Okyay.*et.al*. 2010).

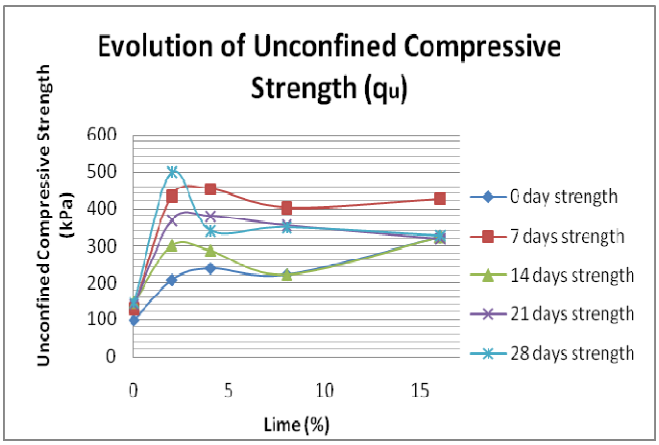


Figure 4. The graph shows value of Unconfined Compressive Strength is optimum when the 2% of lime was added.

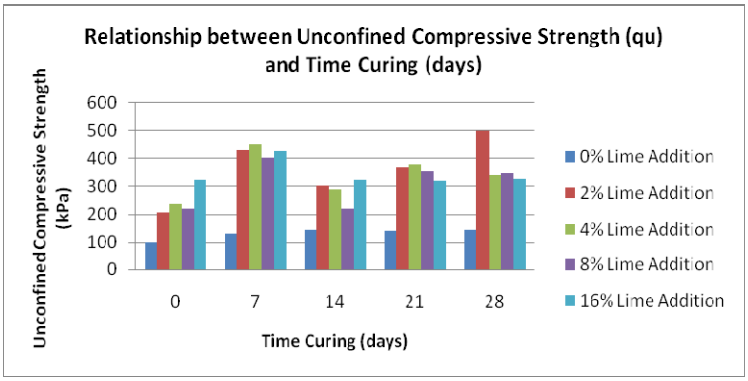


Figure 5. The graph shows the value of Unconfined Compressive Strength is optimum at 28 days after curing with 2% of lime.

Stress-strain behavior

Figure 6. illustrates the stress-strain relationship for stabilized soil with different proportions added of lime. The unstabilised samples shows the stress is lower than 300 kPa. The unstabilized sample shows ductile failure pattern due to the high percentage of clay sizes. It is found also that when 2% of lime was added in soil sample the effective confining pressures were designated at 2.41% strain and 998.5 kPa stress. An increasing in hydrated lime content in clay made the clay sample more brittle (Lin.*et.al*, 2007). Therefore, all stabilized samples have brittle pattern of failure.

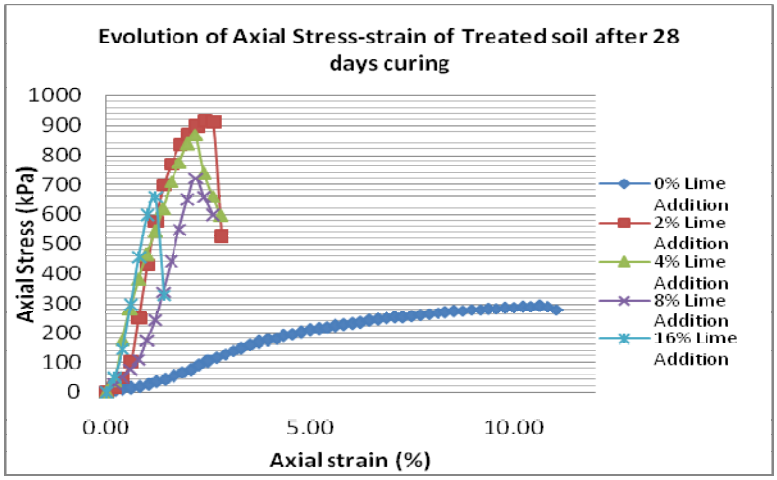


Figure 6. Axial stress-strain of treated soils after 28 days of curing. It shows 2% lime addition at 28 days reach the optimum axial stress than untreated (0% lime addition) soil.

CONCLUSION

- Lime treatment and curing time increased the unconfined compressive strength of soils. The effect of lime treatment with unconfined compressive strength (q_u) is given in Figure 4.
- The natural soil compacted at optimum moisture content gave an unconfined compressive strength is 146 kPa. At a curing 28 days, the unconfined compressive strength value of 2% lime-treated soil increased to 499 kPa.
- This research will be continuing with the SEM (Scanning Electron Microscope) and XRD (X-Ray Diffraction) method for microstructure clay stabilized with lime.

ACKNOWLEDGEMENT

This research is founded by PGD (MOSTI) scholarship. The author also would like to thank Mr. Razali and Mr Jalaludin for their helping on laboratory analysis.

REFERENCES

[1] Al-Mukhtar, M., Lasledj, A., & Alcover, J-C. *Behaviour and Mineralogy Changes in Lime-Treated Expansive Soil at 20ºC* (2010). Applied Clay Sciences. *InPress*.

[2] ASTM. American Society for Testing and Materials. Annual Book of ASTM Standards (1992). vol.4. 08. Philadelphia. New York.

[3] Bell, F.G. *Lime Stabilization of Clay Minerals and Soils* (1996) Engineering Geology 42:223-237.

[4] Bozbey, I., & Garaisayev, S. *Effects of Soil Pulverization Quality on Lime Stabilization of An Expansive Clay* (2009). Environmental Earth Sciences.

[5] Cuisnier, O., Deneele, D., & Masrouri, F. *Shear Strength Behaviour of Compacted Calyey Soils Percolated with An Alkaline Solution* (2009). Engineering Geology. 108:177-188.

[6] Lin, D.F, Long Lin, K., Jui Hung, M., & Lin Luo, H. *Sludge Ash/Hydrated Lime on The Geotechnical Properties of Soft Soil* (2007). Journal of Hazardous Materials. 145:58-64.

[7] Horpibulsuk, S., Rachan, R., Chinkulkijniwat, A., Raksachon, Y., & Suddeepong, A. *Analysis of Strength Development in Cement-stabilized Silty Clay From Microstructural Considerations* (2010). Construction and Building Materials. 24:2011-2021.

[8] Jacobson, G. *Gunung Kinabalu Area, Sabah, Malaysia* (1970). Geology Survey Malaysia. Report 8.

[9] Kalkan, E., & Akbulut, S. *The Positive Effect of Silica fume on The Permeability, Sweeling Pressure and Compressive Strength of Natural Clay Liners* (2004). Engineering Geology. 73:145-156.

[10] Little, D.N. *Stabilization of Pavement Subgrades and Base Courses with Lime* (1995). National Lime Association, Arlington. 219 pp.

[11] Oti, J.E., Kinuthia, J.M., & Bai, J. *Compressive Strength and Microstructural Analysis of Unifired Clay Mansory Bricks* (2009). Engineering Geology. 109:230-240.

[12] Okyay, U.S., & Dias, D. *Use of Lime and Cement Treated Soils as Pile Supported Load Transfer Platform* (2010). Engineering geology. 114:34-44.

[13] Rogers, C.D.F., & Glendinning, S. *Lime Stabilisation* (1996). New York.

[14] Rajasekaran, G., & Narasimha, Rao,S. *The Microstructure of Lime-stabilization Marine Clay* (1997). Ocean Engineering. 24(9):867-878.

[15] Terzaghi, K., Peck, R.B., & Mesri, G. *Soil Mechanics in Engineering Practice* (1996). John Wiley & Sons, Inc, New York.

Trace Fossils Analyisis of Kapilit Formation

Cassidy Aloh[1,*], Sanudin Tahir[1,2]
[1]Geology Programme, School of Science & Technology
Universiti Malaysia Sabah, 88999 Kota Kinabalu, Sabah
cassandreas@gmail.com; tsanudin@ums.edu.my

Abstract
Trace fossils from the Kapilit Formation of the south west of Tawau, Sabah occur in interbedded with coarsing upward of the sandstone of tidal shore and mudstone–shales of a periodically exposed low-energy of the tidal, and interfingerings of both of the above. The trace fossils are represented bioturabation, burrows and trackways. The trace fossils present in the study area are considered as a representative of composite ichnofacies. The trackways of the burrows probably formed on the subaerial deltaic environment exposed following to the shallow marine environment.

Keywords
Trace fossils analysis

INTRODUCTION

Combined field and laboratory studies of surface exposures on the Kapilit Formation (Middle Miocene – Late Miocene), the main topic of the research is aim for the trace fossils analysis. According to Adolf Selaicher, 1967, trace fossils was "fossils behavior" where trace fossils also called ichnofossils or *lebenspuren* are the evidence of animal's activity. For unlike molds and casts which are evidence or replicas of skeletal remains or body impressions. Besides, trace fossils are sedimentology or lithology disturbance from animals or plants activity such as resting, locomotion or feeding.

The research was carried between latitude of N04° 20' to N04°30 and longitude of E117°20' to E117°30', and about 90KM to the south west (SW) of Tawau District which in Kalabakan Palm Oil Estate.

GEOLOGY SETTING

Kapilit Formation is a part of the Neogene basin; which consist of two major facies of inter-bedded between sandstone, mudstone unit and coal deposit.

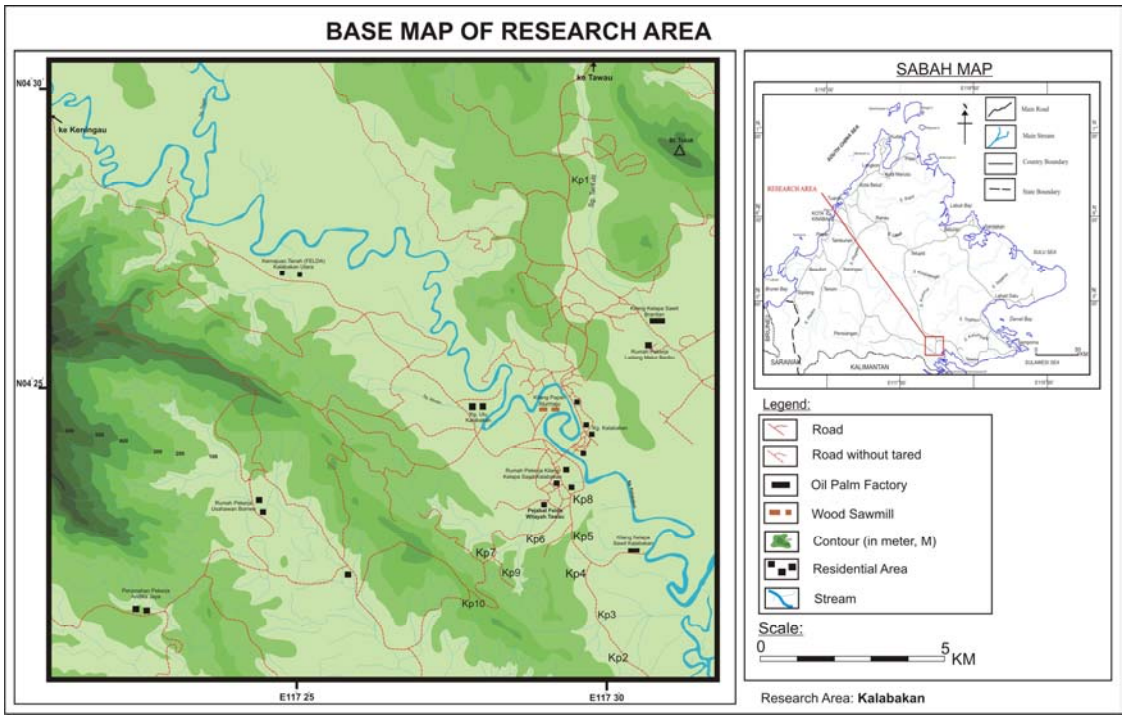


Figure 1 Base map of research area.

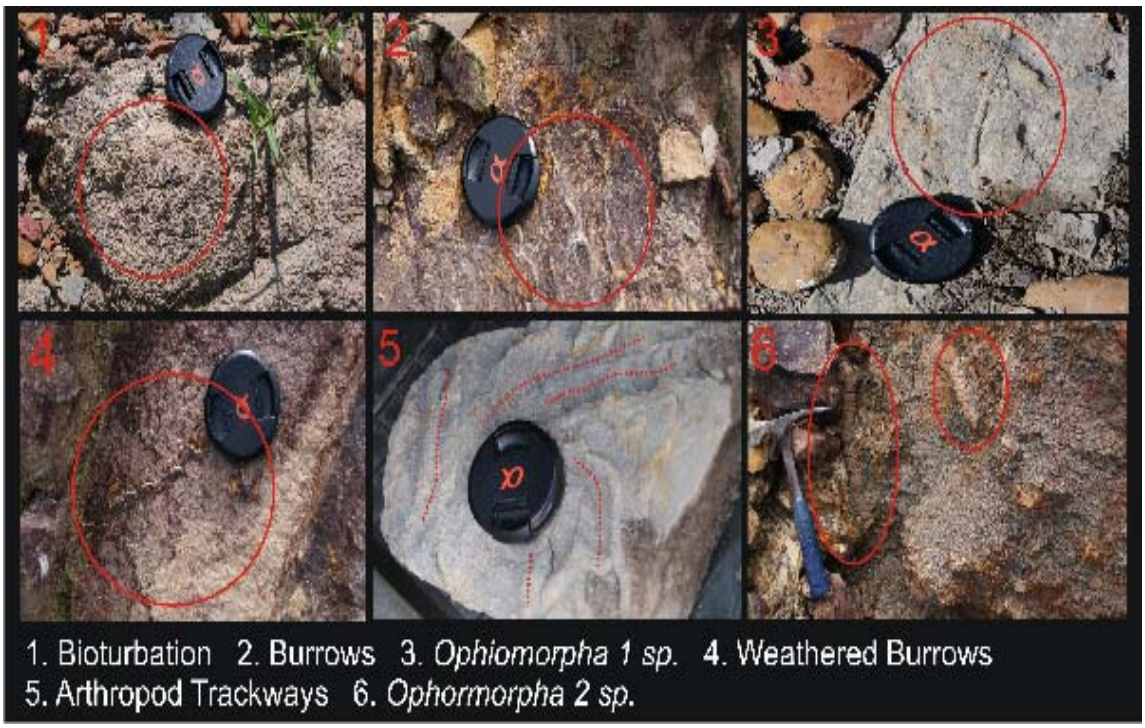


Figure 2 Trace fossils encounter in the study area.

As early 1965 by Collenette, Kapilit Formation is a coarsening-upwards fluvio-deltaic formation, which underlying similar with Tanjong Formation. The formation were divided into two units. The lower is Unit 1 where dominant of mudstone with siltstone beds. On the other hands, the upper part is Unit 2 where consists of sandstone dominant with mudstone and coal seam up to 1 m thickness. Kapilit Formation was shallow marine to fluvial–deltaic facies and formed into sub-circular to elliptical, fault-bounded areas which are known as the 'circular basins' of Sabah (Tongkul, 1990 and Balaguru, 1996).

METHODOLOGY

There are several aspect indicated for the researched. The qualitatif approached is one of the best to show the method of the research. The qualitatif method are based on the collecting data or information on the outcrop which more to collecting data on the primary structure of the rock formation. There are over 50 samples have been collected with 10 differents of the outcrop encountered (see Figure 1). The localities or the outrcrops (sign as Kp) was based on the good exposure on the field and abundanced of trace fossils. The area of stduy was covered around east toward to south part of the researched area.

DISCUSSION

The encountered of the trace fossils from the field are consists of bioturbation, burrows and the organism track ways. For the few samples, there is abundance of burrows which have different kind of pattern. The pattern of the crawling and movement recorded throughout the exposure of the trace fossils on the outcrops. For an example, *Ophiomorpha* (plate 6) mostly the pattern are within a single horizontal plane, probably not far beneath the seafloor, as is indicated by the feeble length of vertical elements (Anderson and Droser, 1998). This is probably made by a type of shrimp or the crustacean. On the other pattern of *Ophiomorpha* (plate 3) is thin tube where the tube was made perpendicular to the sub-base of the sandstone and probably made by the small shrimp or other species of arthropod. Bioturbation is disturbance in those sediments (plate 1) where animal that lives in or on sediments was that digs or burrows are simply moves across the surface somehow created some kind of the disturbance (Ciutat et al., 2005). Meanwhile, the other evidence recorded showing the movement of the organism in or on the outcrops is the organism track ways (Bhargava and Bassi, 1988). It was very distinctive activity and movements of the organism that recorded from the outcrops (plate 5). The trace fossils on the area of study are somehow indicated to the age and the depositional environment where the organism took place. For the example of the burrows especially *Ophiomorpha* where suggested occurred in the habitat of the low tidal deltaic to the shore face

because of the coarsening upward sequence of the inter-bedded between sandstone and mudstones (Balaguru, 2001). The pattern of the bioturbation is therefore suggestive of suspension-feeding activity. The mud comprising the pelleted lining is represented in the substrate sediment, suggesting that it has been collected from suspension by the burrower while suspension feeding. On the other hand, the track ways evidence also indicating the habitat of the organism created them tracking on the shore face - shallow marine environment (Hiscott, 2001). It's shown by typically occur in medium-grained, well sorted sand. Somehow well suggested, the probably organism that encounter the environment was arthropod or the modern setting group of aquatic organism.

CONCLUSION

From the evidence recorded on the field, there are three majors evidence of the trace fossils that indicate the depositional environment of the area. Which consists of bioturbation as a disturbance on the sandstone, burrows especially distinctive *Ophiomorpha* and the organism track ways created by the post organisms. The analysis of trace fossils somehow suggested the distribution of the trace fossils connected and important for indicating the deposition environment on this period. By the outcome of the study, it's shown the characteristic of the deltaic environment with low tidal to the shallow marine environment for deposition of Kaplilit Formation. It was proven by the evidence of trace fossils analysis and supporting information of the previous study of the area.

ACKNOWLEDGEMENT

The authors are grateful to all the members, colleagues and supervisors for the support and guidance in various occasions.

REFERENCES

[1] Ciutat, M. Gerino, P. Anschultz and A. Boudou, *Bioturbartion: effects by Tubificid Oligochaetes on cadmium Transfer and Distribution into Freshwater Sediments*, Environmental Toxicology and Chemistry **60** (3) (2005), pp. 237–246.

[2] Balaguru, A., Nicholas, G.& Hall, R., 2003. *The Origin of the Circular basin of Sabah, Malaysia.* Geo. Society of Malaysia Bull. 46. m/s 336-351.

[3] B.G Anderson and M.L Droser. *Ichnofabrics and Geometrics Configurations Ophimorpha within a Sequence Stratigraphic Framework; an example from Upper Cretacous Western Interior*. Sedimentology 45 (1998) p.p 379-396

[4] Bottjer, D.J. and Droser, M.L. (1994). *The history of Phanerozoic bioturbation. In: Donovan, S.K. (Ed.),* The Paleobiology of Trace Fossils, John Hopkins, Baltimore, pp. 155–176.

[5] Collenette, P. (1954) *The coal deposits and a summary of the Geology of the Silimpopon area, Tawau District, Colony of North Borneo.* Geological Survey Department, British Territories in Borneo, Memoir 2*, 74pp.*

[6] R. N. Hiscott (2001) *Depositional sequences controlled by high rates of sediment supply, sea-level variations, and growth faulting: the Quaternary Baram Delta of northwestern Borneo*. Original Research Article Marine Geology, *Volume 175, Issues1-4*, *15 Pages67-102*

[7] Ekdale, A.A., Bromley, R.G. and Pemberton, S.G. (1984). *Ichnology: The Use of Trace Fossils in Sedimentology and Stratigraphy*, SEPM Publication, Tulsa, Oklahoma, 317 pp.

[8] Leong Khee Meng. (1999) Geological setting of Sabah. *The Petroleum Geology and Resources of Malaysia.* Petroliam Nasional Berhad (PETRONAS), Kuala Lumpur, *chapter 21, pp. 475-497.*

[9] Sanudin Tahir & Baba Musta. 2007. *Pengenalan kepada stratigrafi. Kota Kinabalu*: UMS.

[10] O.N. Bhargava and U.K. Bassi (1988), *Trace fossils from the Palaeozoic–Mesozoic sequence of Spiti-Kinnaur (Himachal Himalaya) with comments on palaeoenvironmental control on their frequency*, *J.* Geol. Soc. India **32** , pp. 227–238.

[11] Seilacher, A. 1964a: *Biogenic sedimentary structures*. In Imbrie, J.; Newell, N.D. (eds.) 1964: *Approaches to paleoecology* . John Wiley & Sons, New York, pp. 296-316.

[12] Seilacher, A. 1964b: *Sedimentological Classification and Nomenclature of Trace Fossils*. Sedimentology 3: 253-256.

[13] Tongkul, F., 2000. *Sedimentologi.* Dewan Bahasa dan Pustaka, Kuala Lumpur.

[14] Wilford, G.E. (1968) *Notes on the Geomorphology of Sabah*. P. Collenette & J. Goh (eds.). Geological Papers 1967. Geological Survey Borneo Region, Malaysia*, Bulletin 9, 1-22.*

A Randomised Clinical Investigation On The Effects Of Dark Chocolate On Anxiety, Depression And Health-Related Quality Of Life Of Palliative Care Cancer Patients

Sok Yee Wong[1], Mohd Rouse Abdul Majid[2], Sapari Satwi[2], Pei Lin Lua[1*]
[1] Centre for Clinical & Quality of Life Studies (CCQoLS),
Universiti Sultan Zainal Abidin (UniSZA), Kampus Kota, Kuala Terengganu, Malaysia.
[2] Hospital Tengku Ampuan Afzan, 25300 Kuantan, Pahang, Malaysia.
* peilinlua@udm.edu.my

Abstract
Health-related quality of life (HRQoL) is a significant concern for oncology patients and its disruption is often related to anxiety and depression (AD). Dark chocolate is perceived to be a healthy food which also contributes to mood regulation. The study investigated the effect of a 3-day dark chocolate consumption on AD and HRQoL among palliative oncology patients. An open-label, parallel experimental study was conducted in a sample of 41 patients from Hospital Tengku Ampuan Afzan (mean age = 47.2 years, age range = 23-69 years, consumption of chocolate a week ≈ 0.80 x 50g). Patients were randomly assigned to Intervention Group (IG) and Control Group (CG). The IG (N = 18) consumed dark chocolate while CG (N = 23) was provided with mineral water for 3 consecutive days. The Malay Hospital Anxiety and Depression Scale (HADS) (domain score ≥ 8 = case) was used to screen for AD levels and McGill Quality of Life Questionnaire (MMQoL) was administered to assess HRQoL. Non-parametric tests were computed for score comparisons. No significant difference between IG and CG in AD and Total MMQoL Score were detected at baseline (all p >0.05). Nevertheless, significant reduction of AD levels was demonstrated between baseline and post-consumption in IG compared to CG (all p <0.01). At post-consumption, the Total MMQoL Score has significantly improved in IG (p <0.001). IG respondents were apparently less anxious and less depressed than CG at follow-up. This study indicated that dark chocolate consumption for 3 consecutive days may alleviate AD and enhance HRQoL status among palliative cancer patients. Further investigations are however warranted to confirm this finding.

Keywords
Dark chocolate, anxiety, depression, health-related quality of life, cancer

INTRODUCTION

Cancer is a chronic degenerative disease where almost all essential organs are involved in the most advances cases. If it is not treated properly and in time, cancer could eventually be fatal. At the initial stage of diagnosis of a life threatening disease and the realization that survival is limited, patients may experience emotions. Depression and anxiety (AD) are the most common psychological problems in cancer care [1]. One quarter of the cancer population is affected by these psychiatric disorders. Depression is also common among early diagnosed cancer patients and those under treatments [2]. In contrast, studies on anxiety are less known than depression. Similarly, anxiety's disabling effects may as burdening as depression [4]. Both AD often are easily treated but difficult to diagnose. If left untreated it can cause overall impairment in health-related quality of life (HRQoL) [3]. Undoubtedly, higher psychological morbidity in cancer patients is likely to worsen the disease progression and shorten survival. Since improving the HRQoL of palliative care patients is essential, efforts should begin from the time a patient is being diagnosed with this incurable disease.

Chocolate is believed to bring tangible benefits for health [5,6]. Most people believed that chocolate invoke anticipatory and consummator pleasure and it is indulgent. Many previous studies had indicated that ingesting chocolate would generate better mood states [7,8,9]. Commonly chocolate is also claimed to have the power of 'lifting up' spirits, creating highs and inducing 'feel good' condition. The interaction of biogenic stimulants and the mouth-feel sensation during chocolate ingestion are believed to be the main contributors of mood regulation [10]. Moreover, the ingestion of dark chocolate in the cancer patients is hypothesized to create a better emotional state which could palliate their overall symptoms, particularly involving emotions. After all, there is still limited trial using dark chocolate as intervention to alleviate AD and HRQoL levels. This study aimed to investigate the effect of a 3-day dark chocolate consumption on AD and HRQoL among cancer patients. Since dark chocolate is palatable and weight gain is not a great distress to palliative patients, it was considered suitable in this study.

Ethical Approval

Approval was obtained from the Medical Research and Ethnics Committee, Ministry of Health Malaysia (reference number: KKM/NIHSEC/08). All of the information on this study was strictly confidential.

STUDY DESIGN AND SAMPLE SELECTION

The study was based on a parallel, prospective, randomized and open-labeled design. A group of palliative cancer care patients were enrolled from

Hospital Tengku Ampuan Afzan, Kuantan. Patients who fulfilled the inclusion criteria only were eligible for participation in the intervention study. Inclusion criteria were: 1) 18 years old and above 2) proficient in Malay language 3) not on anxiolytic medication, psychological treatments or had previous experience with behavioural therapy 4) no food allergy particularly to chocolate 5) non-diabetic 6) no complication in swallowing 7) HADS domain scores ≤ 8 (considered as possible case). Patients with unpredictable changes in condition, with difficulties in swallowing, not cognitively capable to complete questionnaires, or with major mental disturbances/comorbidities that limit meaningful contribution of information were excluded from the study.

Instruments

Eligible patients were instructed to provide their demographic information in the personal particulars form. All of the patients were also provided with a brief *Patient Information Sheet* detailing the purpose of the study followed by the written consent form (signed by those who consented).

The Malay McGill Quality of Life Questionnaire (MMQoL)

The Malay of McGill Quality of Life questionnaire was utilised [11,12]. The five domains assessed were *Physical symptoms* (item 1 to 3), *Physical Well-Being* (item 4), *Psychological Well-Being* (item 5 to 8), *Existential Well-Being* (item 9 to 14) and *Support Issues* (item 15 and item 16). The *Total MMQoL Score* was derived from the mean of all five domains. The first three questions allowed respondents to list their three most problematic physical symptoms affecting their HRQoL. For this study the frames of reference involving 'the past 2 days'.

The Malay Hospital Anxiety and Depression Scale (HADS)

The HADS [3] is a very commonly used instrument in a wide range of patients as well as in non-clinical sample [13]. It represents a simple and reliable tool for use in medical practice. The validated and Malay translated HADS was the instrument of choice in this study [14]. This is a self-screening instrument was used to measure AD levels. It consists of 14 questions, seven for anxiety (HADS-A) and seven for depression (HADS-D). The items are scored on a four-point scale from zero (not present) to three (considerable). The item scores were added, giving sub-scale scores representing the HADS-A and the HADS-D (range = 0 – 21).

STUDY PROCEDURE

Upon official approval, the investigators arranged a meeting with the study centre authorities to decide on the most suitable time and date of commencement. All of the patients gave their informed consents prior to their inclusion in this pilot study. After obtaining the consent, the study proceeded with the administration of the *Personal Particulars Form*, MMQoL and HADS questionnaires (Figure 1). Randomisation into IG and CG followed. At least 2 days before the study begun, all patients were prohibited from consuming any chocolate products and were also instructed to abstain from food for at least 4 hours before chocolate consumption (to avoid possible food interaction effects).

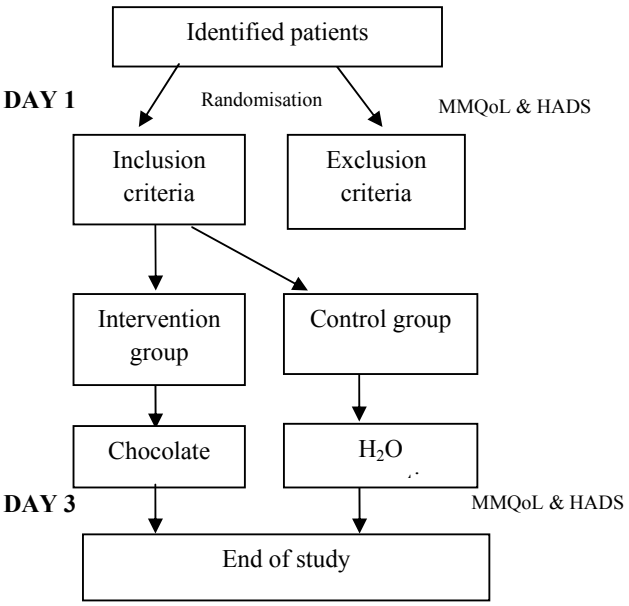


Figure 1. Study procedure.

Data analysis

SPSS 16.0 for Windows was used for data analysis. Socio-demographic data was analyzed descriptively and presented as frequencies. Test of data normality was initially carried out on *Total MMQoL Score* and *Total HADS Score* to determine the type of data distribution which emerged skewed. Subsequent score comparisons were performed using the non-parametric techniques, Mann Whitney U test and Wilcoxon Signed Rank Test. The p-value of less than 0.05 was considered statistically significant.

RESULTS

Demography

The mean age of participants were 47.2 years (age range = 23-69 years). Majority of the patients were Malays (73.2%), and in total there were 19 males (46.3%) and 22 females (53.7%). At the time of the research nearly 88% of the patients were married and were staying with their family or partner. Over 50% of the patients had completed PMR education. The average chocolate consumption per person per week was 0.80 x 50g. A more comprehensive sociodemographic distribution of the recruited patients was presented in Table 1.

Table 1: Demographic and clinical characteristics of patients (n = 41).

	Intervention group [n (%)]	Control group [n (%)]
Gender		
Female	9 (50.0)	13 (56.5)
Male	9 (50.0)	10 (43.5)
Marital Status		
Married	16 (88.9)	20 (87.0)
Single	1 (5.6)	2 (8.7)
Divorce	1 (5.6)	1 (4.3)
Level of education	7 (38.9)	15 (65.2)
> PMR	11 (61.1)	8 (34.8)
< PMR		
Time since diagnosis		
Up to 1 year	17 (94.4)	21 (91.3)
2 years and above	1 (5.6)	2 (8.7)
Type of cancer		
Gynaelogical	6 (33.3)	9 (39.1)
Lung	2 (27.8)	7 (30.4)
Head and neck	3 (16.7)	2 (8.7)
Others	4 (22.2)	5 (21.7)

AD and HRQoL

No significant difference between IG and CG in AD and *Total MMQoL Score* was detected at baseline (all p >0.05). In contrast, significant changes in AD levels and *Total MMQoL Score* were reported for both groups after intervention –Table 2. Significant reduction of AD levels was demonstrated between baseline and follow-up in IG compared to CG (all p <0.01). At post-consumption, the *Total MMQoL Score* was significantly greater in IG ($Baseline_{mean}$ = 6.9, $Follow\text{-}up_{mean}$ = 7.8, p <0.001) –Table 3. At post-consumption, IG respondents were apparently less anxious and less depressed than CG.

DISCUSSION AND CONCLUSION

A 3-day dark chocolate consumption intervention seemed to elicit reduction of AD levels as well as enhancing better HRQoL status among Pahang cancer patients. These results were in parallel with prior studies that discovered AD levels and HRQoL significantly improved for patients who received DC for 3 consecutive days [9,15]. Although patient's daily food intake was not controlled but they were instructed to abstain from food 4 hours before the intervention study to avoid possible food interaction effects. The oro-sensory aspects, the pharmacologic components and the carbohydrate contents were perceived to be possible contributors in alleviating AD and improving HRQoL levels [9]. Further limitations of this study included the limited sample size. Therefore the results may not be generalised to other sample of patients. In the future, studies on dark chocolate investigating the effect on AD and well-being along with structured diagnostic interviews and examination of biophysiological factors are highly recommended.

Table 2: Between-group score comparisons for HADS and MMQoL.

		Baseline		Follow-up	
		M	p*	M	p*
HADS-A	IG	8.0	>0.05	4.0	<0.001
	CG	8.1		8.0	
HADS-D	IG	11.5	>0.05	3.0	<0.001
	CG	11.0		9.0	
Physical symptoms	IG	5.0	>0.05	7.0	<0.05
	CG	6.0		7.0	
Physical Well-Being	IG	8.2	>0.05	9.5	<0.001
	CG	8.0		8.3	
Psychological Well-Being	IG	4.5	>0.05	6.0	>0.05
	CG	4.8		5.2	
Existential Well-Being	IG	7.6	>0.05	8.8	>0.05
	CG	8.0		8.7	
Support Issues	IG	9.5	>0.05	9.8	>0.05
	CG	9.0		9.5	
Total MMQoL Score	IG	6.9	>0.05	8.2	<0.05
	CG	7.0		7.7	

M = median; *Mann-Whitney U test.

Table 3: Within-group score comparisons for HADS and MMQoL.

	Baseline Mean (M)	Follow-up Mean (M)	p*
HADS-A	8.0 (11.0)	6.1 (6.0)	<0.01
HADS-D	11.0 (8.0)	5.9 (6.0)	<0.001
Physical symptoms	8.0 (7.9)	8.7 (8.7)	<0.01
Physical Well-Being	5.9 (6.0)	6.9 (7.0)	<0.01
Psychological Well-Being	4.4 (4.8)	5.8 (5.3)	<0.001
Existential Well-Being	7.5 (8.0)	8.5 (8.7)	<0.05
Support Issues	8.8 (9.5)	9.2 (9.5)	>0.05
Total MMQoL Score	6.9 (7.0)	7.8 (7.9)	<0.001

M = median; *Wilcoxon Rank Signed test.

ACKNOWLEDGEMENTS

We gratefully acknowledged all the patients who had given full commitment and successfully participate in this study, as well as Dr. Suthahar Ariatnam, Dr. Chan Tze Lin, and Miss Lim Bee Chiu for their help and support. This study was funded by university grant [UDM/09/BR(003)] from the Centre for Research Management and Innovation, Universiti Sultan Zainal Abdidin (UniSZA), Kuala Terengganu, Malaysia.

REFERENCES

[1] Wilson, K.G., Chochinov, H.M., Skirko, M.G., Allard, P., Chary,S., Gagnon P.R., et al. Depression and Anxiety Disorders in Palliative

Cancer Care. *J Pain Sympt Manage* 33 (2007), 118-129.

[2] Bodurka-Bevers, D., Basen-Engquist, K., Carmack, C.L., Fitzgerald, M.A., Wolf, J.K., de Moor, C., Gershenson, D.M. Depression, anxiety, and quality of life in patients with epithelial ovarian cancer. *Gynecol Oncol,* 78 (2000), 302-308.

[3] Rodin, G., Zimmermann, C., Rydall, A., Jones, J., Shepherd, F. A., Moore, M., Fruh, M., Donner, A., Gagliese, L. The desire for hastened death in patients with metastatic cancer. *J Pain Sympt Manage,* 33(6) (2007), 661–675.

[4] Roy-Byrne, P.P., Davidson, K.W., Kessler, R.C., Asmundson, G.J., Goodwin, R.D., Kubzansky, L., Lydiard, R.B., Massie, M.J., Katon, W., Laden, S.K., Stein, M.B. Anxiety disorders and comorbid medical illness. *Gen Hosp Psychiatry*, 30(3), (2008) 208-225.

[5] Dillinger, T.L., Barriga, P., Escarcega, S., Jimenez, M., Salazar Lowe, D., & Grivetti L.E. Food of the gods: cure for humanity? A cultural history of the medicinal and ritual use of chocolate. *J Nutr*. 130, (2000) 2057S-2072S.

[6] Muniyappa, R., Hall, G., Kolodziej, T., & Karne, R. Cocoa consumption for two week enhances insulins-mediated vasodilation without improving blood pressure or insulin resistance in essential hypertension. *Am J Clin Nutr*, 88(6), (2008) 1685 -1696.

[7] Visioli, F., Bernaert, H., Corti, R., Ferri., C., Heptinstall, S., Molinari, E., et al. Chocolate, Lifestyle, and Health. *Crit Rev Food Sci Nutr*, 49, (2009) 299-312.

[8] Mumford, G.K., Benowitz, N. L., Evans, S. M., Kaminski, B.J., Preston, K.L, Sannerurd, C.A., et al. Absorptions rate methylxanthines following capsules, cola and chocolate. *Eur J Clin Pharmacol,* 51, (1996) 319-315.

[9] Macht, M., Dettmer D. Everyday mood and emotions after eating a chocolate bar or an apple. *Appetite,* 46(3), (2006) 332-336.

[10] Macht, M., Jochen M. Immediate effects of chocolate on experimentally induced mood states. *Appetite,* 49(3), (2007) 667-674.

[11] Lua, P.L., Salek, S., Finlay, I., Boay, A.G.I. Mohd. Said, R. Comparisons of health-related quality of life in Sabah cancer population receiving different treatment modalities. *J Kinabalu*, 9, (2003) 21-43.

[12] Lua, P.L. The Malay McGill Quality Of Life Questionnaire (MMQOL): Adaptation and validation. *University Publication Centre (University Teknologi Mara),* (2006) 6-34.

[13] Hatta, S.M., Hamid, A.R., Jaafar, R., Hamed, N., Jalil, N.F., Mustafa, N. Depressive symptoms among women after abortion. *Msian J Psychiatry* 5 (1997) 27-33.

[14] Zigmond, A., Snaith, R.P. The Hospital Anxiety and Depression Scale. *Acta Psychiatr Scand* 67 (1983) 361-370.

[15] Wong, S.Y., Lua,P.L., Abdul Latif, A.Z., Ismail, R., Ibrahim, A.M. Exploring dark chocolate's effect on mood and HRQOL in palliative care. *Proceedings of the 4th National Conference for Clinical Research (NCCR) (2010), 1-*

Patients With Epilepsy In Terengganu: A Preliminary Exploration Of Health-Related Quality Of Life (HRQoL) Profile

Neni Widiasmoro Selamat and Pei Lin Lua*
Centre For Clinical And Quality of Life Studies (CCQoLS)
Faculty of Medicine And Health Sciences
Universiti Sultan Zainal Abidin (UniSZA), Kampus Kota
20400 KualaTerengganu, Malaysia.
* peilinlua@udm.edu.my

Abstract
Assessment of health-related quality of life (HRQoL) is a crucial step to improve the services offered by healthcare providers so that holistic outcomes for patients can be achieved. Our study aimed to 1) determine general HRQoL level and 2) compare HRQoL based on socio-demographic characteristics. A cross-sectional sample of epilepsy out-patients was recruited from the Neurology Clinic, Hospital Sultanah Nur Zahirah, Kuala Terengganu. Descriptive and non-parametric statistics were employed for data analysis (SPSS 16). Eligible and consenting patients completed the Malay Quality of Life In Epilepsy (MQOLIE-30) instrument. Sixty out of 72 patients (response rate = 83.3%) consented participation (median age = 27.5 years; male = 53.3%; unmarried = 63.3%; Malay = 90.0%; SPM education = 54.2%; unemployed = 35.0%; rural residents = 70.0%). Across all patients, the overall HRQoL was moderate (median = 51.5; range 15-97). The highest domain score was for Cognitive Functioning (median = 14.4; range 0-24.3) while Social Functioning was the poorest domain (median = 9.7; range 0-21), indicating the important need to manage patients' social issues in addition to improving cognitive status. Overall, patients who were female, married and living in urban areas reported relatively better HRQoL compared to their respective counterparts although these findings were not significant (p>0.05). The small sample size has probably diminished the possibility of detecting significant differences between groups. Nonetheless, the results suggested that continuous efforts should be carried out to enhance health outcomes for people with epilepsy (PWE) with particular focus on HRQoL.

Keywords
Epilepsy, health-related quality of life (HRQoL)

INTRODUCTION

Epilepsy is one of the most common neurological problems, affecting approximately 1% of Malaysian population [1]. Although rendering patients' "seizure free" is the ultimate goal of treating persons with epilepsy (PWE), it has become obvious that in addition to seizures, many other issues affect their health-related quality of life (HRQoL). These include social stigma, employment, marriage, relationship, driving and also comorbid conditions. Epilepsy negatively affects social, vocational and psychological function [2]. Living with uncontrolled epilepsy implies psychosocial challenges and a reduced HRQoL [3-9]. The problems may be related to the experience with epilepsy itself and to the perceived social stigma associated with the diagnosis. Health professionals often exclusively focus on the medical aspects of the disorder. Less attention has been given to the impact of epilepsy on everyday life, such as the patient's own perception of the disorder, the adjustment to treatment, and the ability to manage the effects of the seizures. Psychosocial difficulties may be a greater problem than the physical symptoms of the disease [10,11]. Insufficient information about the disorder and inadequate professional support are common. Although the HRQoL of a person with epilepsy is primarily determined by the duration of the disease and the extent of seizure control, other non-epileptic parameters such as social and psychological factors are also pertinent. Closely inter-related social factors include social anxiety, employment and social stigma [12,13]. Therefore, in order to improve the HRQoL of PWE, and to enhance their level of acceptance in the society as well as to reduce the public's stigma, it is necessary to evaluate the HRQoL alongside enhancement of awareness, knowledge and understanding of the impact of epilepsy on HRQoL and cultivate positive attitudes towards this neurological disorder. Thus, this study aimed to determine general HRQoL level of PWE and to compare HRQoL based on their socio-demographic characteristics.

METHODS

Study Design and Sample Selection

This prospective cross-sectional pilot study was carried out in the Neurology Clinic, Hospital Sultanah Nur Zahirah (HSNZ), Kuala Terengganu, Malaysia. It was conducted for a two-month period. The sample size was determined according to the descriptive observational cross-sectional study formula specific for pilot study [14]. According to the formula, at least **39** patients were needed for this study.

Ethical Approval
Before the study begins, ethical approval was first obtained from the Medical Research and Ethics Committee of the Ministry of Health, Malaysia (reference: (2) dlm.KKM/NIHSEC/08/0804/P10-158) via online application.

Data Collection Procedure
Data was collected on the epilepsy clinic day to avoid burdening the patients by having to visit the hospital for study participation as well as for their regular clinic appointment. On the agreed meeting day, the researchers and assistants met, explained and invited potential patients to participate in the study. Potential patients were defined as those who met and satisfied all the inclusion criteria for this study. The inclusion criteria were; 1) epilepsy patients aged 18 years old and above, 2) had been regularly attending hospital at least for the past 6 months, 3) should be able to either understand, read, speak or write in Malay language and 4) capable to answer the questions either in written form or by interview. An information sheet was given to enhance their understanding on the nature of the study as well as to clarify the particulars needed, the instrument used and what was required from them. Once agreed, participants signed a written consent form and proceeded to complete Personal Information Form and *Malay QOLIE-30* [15].

Instrument
Malay QOLIE-30 [15]
This is the HRQoL tool of choice in epilepsy research [16]. Besides being widely used, it has also proven to be reliable [17]. Developed from the original English QOLIE-31 [18], this instrument contained 30 items tapping on 7 domains: *Emotional Well-Being* (5 items), *Social Functioning* (4 items), *Energy/Fatigue* (3 items), *Cognitive Functioning* (6 items), *Seizure Worry* (5 items), *Medication Effects* (4 items) and *Overall QoL* (2 items) and a single item assessing *Overall Health*. Responses are scored on a mixture of numerical scale (0-10) and Likert choices (1-3, 1-4, 1-5, 1-6). All scale scores were transformed linearly into scales of 0-100 with higher values indicating better functioning and well-being. The *Total HRQoL Score* was derived by weighting and summing the scale scores according to the guidelines in the manual [18].

Statistical Analysis
This study employed Statistical Package for Social Sciences version 15 (SPSS 15) for the purpose of statistical analysis of the data. All socio-demographic data were analysed descriptively and presented as frequencies and percentages. Non-parametric tests such as the chi-square for goodness of fit was employed to test for homogeneity of categorical variables and Mann-Whitney U test was carried out to test for between-group score comparisons (HRQoL level according to sociodemographic background).

RESULTS
Socio-demographic Characteristics
Sixty out of 72 out-patients (response rate = 83.3%) diagnosed with all subtypes of epilepsy participated in this study. The median age was 27.5 years, ranging from 18 to 65 years. Most of the respondents were Malay (90.0%), Muslim (90.0%), single (63.3%), possessed education level at SPM or lower (81.4%), unemployed (58.4%), were earning not more than RM 500 (68.4%), and living with spouse or family (96.7%) in rural areas (70.0%). Further details are shown in Table 1.

Table 1. Socio-demographic characteristics of sample respondents (n=60).

Variables	Mean	Standard deviation	Median
Age	31.07	11.07	27.5
	Frequency (n)	Percentage (%)	p value*
Gender			
Male	32	53.3	
Female	28	46.7	0.606
Marital status			
Married	20	33.3	
Single	38	63.3	**<0.001**
Widowed	2	3.3	
Race			
Malay	54	90.0	
Chinese	6	10.0	**<0.001**
Religion			
Muslim	54	90.0	
Buddhist	6	10.0	**<0.001**
Education level **			
No formal education	2	3.4	
Primary school	8	13.6	
SRP/PMR or equivalent	6	10.2	
SPM or equivalent	32	54.2	**<0.001**
STPM	1	1.7	
Diploma or equivalent	8	13.6	
Degree or equivalent	2	3.4	
Occupation			
Professional	2	3.3	
Supportive	5	8.3	
House-wife	18	30.0	
Retiree	7	11.7	**<0.001**
Student	7	11.7	
Unemployed	21	35.0	
Monthly income **			
RM 500 and below	39	68.4	
RM 501-RM 1,000	8	14.0	
RM 1,001-RM 1,500	2	3.5	
RM 1,501-RM 2,000	2	3.5	**<0.001**
RM 2,001-RM 2,500	1	1.8	
RM 2, 501 and above	5	8.8	
Living arrangement			
Alone	1	1.7	
With spouse/family	58	96.7	
Rent a room	1	1.7	**<0.001**
Living area			
Urban	18	30.0	**<0.01**
Rural	42	70.0	

* Chi-square test for goodness of fit.
** contains missing data, thus n≠60.

General HRQoL Levels
Generally, HRQoL level of epileptic patients in Terengganu was considered moderate. This was shown by the *Total HRQoL* score ranging from 12.7 to 89.6 (mean = 52.6 ± 17.5, median = 51.5). Among all the domains, *Cognitive Functioning* emerged the lowest with scores ranging from 0.0 to 24.3 (mean = 13.4 ± 6.0, median = 14.4) while *Emotional Well-Being, Social-Functioning, Energy/Fatigue, Seizure Worry*, *Medication Effects* and *Overall Quality of Life* demonstrated moderate outcomes – Figure 1.

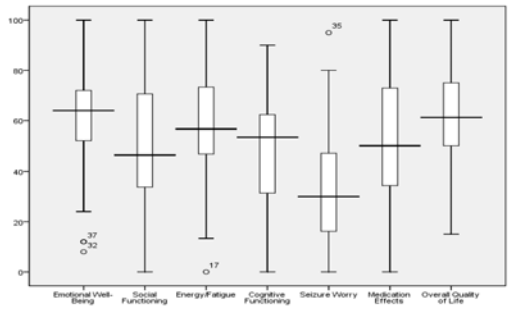


Figure 1. Box-whisker plot showing a general distribution of the health-related quality of life (HRQoL) scores.

Comparisons of HRQoL Profile Based on Socio-demographic Characteristics

Overall, patients who were female, married and living in urban areas reported relatively better HRQoL compared to their respective counterparts although these findings were not significant (p>0.05) – Table 2.

Table 2. Health-related quality of life (HRQoL) based on sociodemographic profile.

Domain	Mean Ranks						p value*
	Gender		Marital Status		Area of Living		
	Male	Female	Single	Married	Urban	Rural	
Emotional Well-Being	29.28	31.89	28.20	31.98	30.86	30.35	>0.05
Social Functioning	29.17	32.02	29.26	29.95	31.11	30.24	>0.05
Energy/Fatigue	31.70	29.12	26.51	35.18	29.56	30.90	>0.05
Cognitive Functioning	28.61	32.66	27.92	32.50	35.11	28.52	>0.05
Seizure Worry	29.09	32.11	29.59	29.32	31.89	29.90	>0.05
Medication Effects	29.02	32.20	29.39	29.70	32.31	29.73	>0.05
Overall Quality of Life	30.59	30.39	26.93	34.38	26.67	32.14	>0.05
Total HRQoL	29.34	31.82	27.92	32.50	31.78	29.95	>0.05

*Mann-Whitney U test.

DISCUSSION

With regard to general HRQoL, only moderate level was shown within our sample. This was in parallel with the results obtained by studies conducted in United States of America [19] and Malaysia [15]. However, the overall HRQoL of our sample was somehow comparatively better than PWE in Russia whereby their overall HRQoL was rather low; 42.1 ± 4.1[20]. Every domain except for *Cognitive Functioning* was all moderately-rated. This was supported by a previous study which claimed that cognitive impairment has been implied as the highest potential problem for epilepsy patients [7], strengthening the argument on its importance in dealing with this disease. Cognitive deficits involving visual motor tasks, mental flexibility and memory have been reported in PWE with partial or generalized seizures prior to treatment with antiepileptic drugs (AEDs) [21]. Furthermore, a wide range of variables may underlie cognitive impairment in epilepsy including biologic, psychosocial and treatment-induced factors [22-24]. Therefore, it has been suggested that time-consuming cognitive rehabilitation programmes should be offered since they can provide new insights to the patients [25] in the process of improving their cognitive function.

CONCLUSION

The small sample size has probably diminished the possibility of detecting statistical differences between groups. The moderate HRQoL level of PWE in Terengganu should be taken as an indication that improvement in health outcomes is a priority for healthcare providers and responsible authorities. Nonetheless, the results suggested that continuous efforts should be carried out to enhance health outcomes for PWE with particular focus on HRQoL.

ACKNOWLEDGEMENTS

We very much appreciated the cooperation from all participants and their families for their support towards this study. We also would like to express our thanks and gratitude to Dr. Zariah Abdul Aziz, Dr. Azman Abu Bakar and Dr. Sondi Sararaks for their valuable advice and help. We must thank Sr. Hasmah Sabur, Mrs Rohani Mohamad, Mr Kartawinatar Yusof, Ms Putri Wan Elena Wan Dali, Ms Tuan Sharifah Diana Syed Ahmad and Ms Noor Liza Jailani for their valuable assistance during the data collection process. Our appreciation also goes to the Pusat Pengurusan Penyelidikan dan Inovasi UniSZA for their financial support [grant no: UniSZA/10/BR (029)].

REFERENCES

[1] Statistics by country for epilepsy. Retrieved September 5, 2010, from http://www.cureresearch.com/e/epilepsy/stats-country.htm

[2] Gilliam, F., Hecimovic, H., Sheline, Y. Psychiatric comorbidity, health and function in epilepsy. *Epilepsy Behav* 4 (2003) 26-30.

[3] Leidy, N.K., Elixhauser, A., Vickrey, B., Means, E., William, M.K. Seizure frequency and the health-related quality of life of adults with epilepsy. *Neurology* 57 (2001) 69-73.

[4] Levin, R., Banks, S., Berg, B. Psychosocial dimensions of epilepsy: A review of the literature. *Epilepsia* 29 (1988) 805-816.

[5] Suurmeijer, T.P., Reuvekamp, M.F., Aldenkamp, B.P. Social functioning, psychological functioning and quality of life in epilepsy. *Epilepsia* 42 (2001) 1160-1168.

[6] Collings, J.A. Psychosocial well-being and epilepsy: an empirical study. *Epilepsia* 31 (1990) 418-426.

[7] Fisher, R.S., Vickrey, B.G., Gibson, P., Hermann, B., Penovich, P., Scherer, A., et al. The impact of epilepsy from the patient's perspective: Descriptions and subjective perceptions. *Epilepsy Res* 41 (2000) 39-51.

[8] Stavem, K., Loge, J.H., Kaasa, S. Health status of people with epilepsy compared with a general reference population. *Epilepsia* 41 (2000) 85-90.

[9] Shackleton, D.P., Kasteleijn-Nolst Trenite, D.G.,

de Craen, A.J., Vandenbroucke, J.P., Westendorp, R.G. Living with epilepsy: long-term prognosis and psychosocial outcomes. *Neurology* 61 (2003) 64-70.

[10] Baker, G.A., Brooks, J., Buck, D., Jacoby, A. The stigma of epilepsy: a European perspective. *Epilepsia* 41 (2000) 98-104.

[11] MacLeod, J.S., Austin, J.K. Stigma in the lives of adolescents with epilepsy: a review of the literature. *Epilepsy Behav* 4 (2003) 112-117.

[12] Jacoby, A. Stigma, epilepsy, and quality of life. *Epilepsy Behav* 3 (2002) 10-20.

[13] Schachter, S.C. Improving quality of life beyond seizure control. *Epileptic Disord* 7 (2005) 34-37.

[14] Naing, N.N. *A practical guide on determination of sample size in health sciences research: Sample size determination in descriptive studies*. Pustaka Aman Press Sdn. Bhd., Kelantan, Malaysia (2009).

[15] Lua, P.L., Cosmas, G., Md. Nawi, N.H. *The burden of epilepsy: Quality of life and coping strategies*. Universiti Teknologi MARA, University Publication Centre (UPENA), Selangor, Malaysia (2007).

[16] Leone, M.A., Beghi, E., Righini, C., Apolone, G., Mosconi, P. Epilepsy and quality of life in adults: A review of instruments. *Epilepsy Res* 66 (2005) 23-44.

[17] Vickrey, B.G., Hays, R.D., Hermann, B.P., Bladin, P.F., Batzel, L.W. *Outcomes with respect to quality of life. In J. Engel Jr. (Ed.), Surgical treatment of the epilepsies*, 2nd ed., Raven Press Ltd., New York (1993).

[18] Vickrey, B.G., Perrine, K., Hays, R., Hermann, B., Cramer, J., Meador, K., Devinsky, O. *Quality of life in epilepsy- QOLIE-31*. Scoring manual (1993).

[19] Devinsky, O., Vickrey, B.G., Cramer, J., Perrine, K., Hermann, B., Meador, K., Hays, R. Development of Quality of Life In Epilepsy Inventory. *Epilepsia* 36 (1995) 1089-1104.

[20] Guekht, A.B., Mitrokhina, T.V., Lebedeva, A.V., et al. Factors influencing on quality of life in people with epilepsy. *Seizure* 16 (2007) 128-133.

[21] Pulliainen, V., Kuikka, P., Jokelainen, M. Motor and cognitive functions in newly diagnosed adult seizure patients before antiepileptic medication. *Acta Neurol Scand* 101 (2000) 73-78.

[22] Meador, K.J., Gilliam, F.G., Kanner, A.M., Pellock, J.M. Cognitive and behavioral effects of antiepileptic drugs. *Epilepsy Behav* 2 (2001) 1-17.

[23] Austin, J.K., Dunn, D.W. Progressive behavioral changes in children with epilepsy. *Prog Brain Res* 135 (2002) 419-427.

[24] Binnie, C.D. Cognitive performance, subtle seizures and the EEG. *Epilepsia* 42 (2001) 16-18.

[25] Engelberts, N.H.J., Klein, M., van der Ploeg, H.M., Heimans, J.J., Jolles, J., Kasteleijn-Nolst Trenite, D.G.A. Cognition and health-related quality of life in chronic well-controlled patients with partial epilepsy on carbamazepine monotherapy. *Epilepsy Behav* 3 (2002) 316-321.

Comparison on the Effect of Different Carbon Dioxide (CO_2) Flow Rate on Microalgae (*Tetraselmis chuii*) Cell Density and Biomass Concentration Cultivated in Closed Photobioreactor

Janarthanan.S #1[1]'*, Kumaran.P #2[1,2] and Saifudin.N #3[1]

[1]Department of Mechanical Engineering #1

[3]Department of Engineering Science and Mathematic #3

Universiti Tenaga Nasional

Jalan Ikram-Uniten,

43009 Kajang,Selangor, Malaysia

*janarthanan2020@yahoo.com

Abstract

Global warming which is mainly caused by release of harmful gas such as carbon dioxide (CO_2) from the mitigation of fossil fuel. In order to encounter this environmental problem, microalgae have been identified as the potential source that could sequesters the CO_2 and the same time it produce lipids similar to vegetable oil which can be converted into biodiesel. Based on the current environment issue, this study was conducted to explore the effect of different CO_2 flow rate #1 50ml/min CO_2 and #2 100ml/min CO_2. The microalgae were cultivated in F/2 medium at 25°c. The result shows microalgae cultivated at condition (ii) have higher cell density,3.1×10^6cell/ml and biomass concentration 5640mg/L compared to condition (i) have low cell density, 2.3×10^6cell/ml and biomass concentration 5080mg/L. Based on the observation ,microalgae may able to produce more biomass and high growth rate when cultivated in high CO_2 flow rate. Further research will be conducted to explore the maximum CO_2 flow rate that are able to capture by the microalgae in order to produce high yield of biomass concentration and cell density.

Keywords

Global warming, CO_2, microalgae.

INTRODUCTION

The use of petroleum from fossil fuel as energy is unsustainable and produce green house gas such CO_2 which is the main cause of global warming.

In order to overcome to problem, many researches have been concentrated in the field of renewable energy. Among the most popular and technically viable renewable energy is biodiesel [1][2]. The current usage of feedstock for biodiesel such as vegetable oil (corn, soya been and palm oil) is limited due to large land requirement for the plantation of the crops and being consume as a food source for human. Due to this problem, researches have identified microalgae as one of the most promising feedstock for continuous production of biodiesel because of its ability to synthesis triglycerides and it also consume CO_2 for photosynthesis process which produces oxygen (O_2) as a end product [3]. Even though microalgae have many advantages over other biodiesel feedstock, but large land requirement to built race away ponds for cultivation and contamination by other unwanted microorganism are two major cause which impeding the usage of microalgae for biodiesel production. Based on literature review, *T.chuii* have the capability to produce lipids which are suitable for biodiesel production yet this strain have fast growth rate [5] and available locally. In this study the effect of different CO_2 flow rate on the cell density and biomass concentration was explored since there were less documentation on the appropriate CO_2 flow rate that needed by *T.chuii* in order to produce high cell density and biomass concentration in a closed photobioreactor. The objective of this study is to determine suitable flow rate needed by the *T.chuii* to produce high yield of biomass concentration and cell density. This study may contribute to the existing knowledge pool on the amount of CO_2 that can be consumed by different microalgae species.

MATERIALS AND METHOD

Microalgae Strain and Medium Preparation

T.chuii strain (Figure 1) was purchased from Algaetech Sdn Bhd and sub cultured the strain in a two 1000ml conical flask before transferring the strain into 20L photobioreactor. Artificial seawater and modified F/2 medium (3ml/L of sodium nitrate, $NaNO_3$, monosodium phosphate monohydrate, 1ml/L $NaH_2PO_4.H_2O$ and 1ml/L trace metal solution) was used as a growth medium. For condition #1 50 ml/min CO_2 and for condition #2 100 ml/min of CO_2 flow rate was supplied to the culture medium. In this study, CO_2 level were adjusted because based on literature high CO_2 level may trigger rapid microalgae cell division due to the environment condition which also influence the biomass concentration and cell density [8].

Figure 1. *T. chuii* strain

Growth condition

T.chuii cell density was observed daily using Millscience Neubauer Hemacytometer [6] and the pH is measured using Mettler Toledo pH meter. Artificial light at wavelength of 380-450 nm was used as a source of energy for the photosynthesis process since it is the most suitable for microalgae growth and the photoperiod of the medium was maintain at 12hour in light condition and 12 hour in dark condition [10]. Exposing the microalgae culture for longer time in light or high light intensity may damage cell and would require longer dark period for the microalgae to recover from the damage [7]. Salinity of the growth medium was adjusted to 22g l^{-1}, since the suggested salinity for the marine species growth was between 20-24g l^{-1}[8]. The salinity was measured using Marine Salt Testa, Trans Instrument. The temperature was maintained at 25°C using Wise Circu temperature controller since the most suitable condition for the microalgae growth is 16 – 27°C and temperature lower than 16°C may slow down the growth whereas those higher than 35°C may be lethal to *T.chuii* [10].

Measurement of cell density and biomass concentration

The cell density and biomass concentration of *T.chuii* was collected every 2day (by 1 day interval). The cell density was measured using Millscience Neubauer Hemacytometer [6]. 1 ml of sample were collected from the photobioreactor and placed in a Ependorf tube and mixed with Lugol's Iodine in order to prevent the movement of *T.chuii* when observing under microscope. The mixed sample were later placed in the hemacytometer and the cover slip was placed on the of hemacytometer before observed using microscope [6]. The biomass concentration was obtained by weighing the dry biomass of microalgae sample.

50ml of microalgae sample were collected from the photobioreactor and filtered through a pre-dried and pre-weighted filter paper (110m – Whatman). The filter paper with microalgae biomass was dried in a incubator oven at temperature 70°C for 24 hours. After the drying process the filter paper weight was measured using AND 6100 model weighing scale obtain the biomass concentration of the microalgae as shown in figure 2 [11][12].

Figure 2. Microalgae biomass on the filter paper

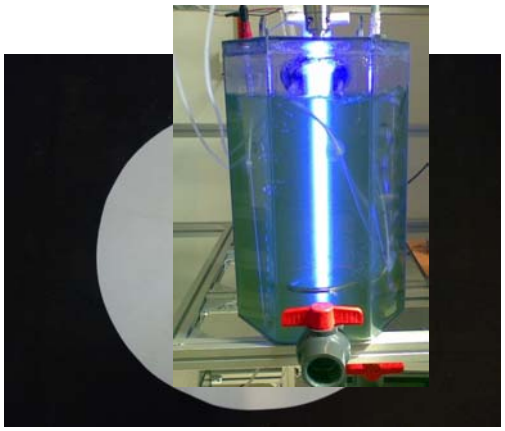


Figure 3. Phobioreactor system which is used to cultivate microalgae

RESULT AND DISCUSSION

A closed system photobioreactor was developed. Instead of using mechanical system which require additional electricity energy in order to maintain the homogenous condition, aeration and mixing was provided by bubbling air. Internally fixed bulb is used to illuminate the photobioreactor. Figure 3 shows the photobioreactor system which was used to cultivate *T.chuii*. Based on the result below, *T.chuii* cultivated in (ii) condition have higher biomass concentration (Figure4) which is 5640 mg/L compared to *T.chuii* cultivated in (i) condition which is 5080 mg/L. Whereas, *T.chuii* cell density observed were showing the similar result as biomass concentration where *T.chuii* cultivated in (ii) have higher cell density (Figure5) which is 3.1×10^6 cells/ml compared to *T.chuii* cultivated in (ii) condition which is 2.3×10^6 cells/ml. Reading was taken every two days starting from second day but at starting of cultivation the biomass concentration and cell density was taken for first and second day in order to ensure the survival of microalgae cultivated in a new environment. *T.chuii* biomass concentration was high in standard condition may due to sufficient nitrogen source which promote the growth of microalgae and increase the cell density.

T.chuii biomass concentration was high in #2 condition may due to sufficient nitrogen source and high CO_2 flow rate which promote the growth of microalgae which increase the cell density. On the both above result, biomass concentration and cell density was observed at the peek during the end of exponential phase due to the nutrient level in the culture medium is depleting and at the same time triacylglcerol is being produced as source of energy to the detriment of cell division [8]. Biomass concentration depends on the lipid production of the microalgae cell [9]. CO_2 plays an important role in photosynthesis process where microalgae uses light

energy to produce organic compound such lipid and protein by combining water and CO_2. Generally the amount of dissolved CO_2 occurring in 1L of seawater was 0.23 ml. During photosynthesis, the free CO_2 dissolved in water will be taken up (0.23ml) and bicarbonate (H_2CO) and carbonate ion (CO^{2-}_3) will be produced.

$$HCO^-_3 \rightleftharpoons CO^{2-}_3 + H^+$$

When free CO_2 is used up, reverse reaction takes place the free CO_2 is generated from HCO^-_3 and CO^{2-}_3.

$$CO^{2-}_3 + 2H^+ \rightleftharpoons H_2CO_3 \rightleftharpoons CO_2 + H_2O$$

$$HCO^-_3 + H^+ \rightleftharpoons H_2CO_3 \rightleftharpoons CO_2 + H_2O$$

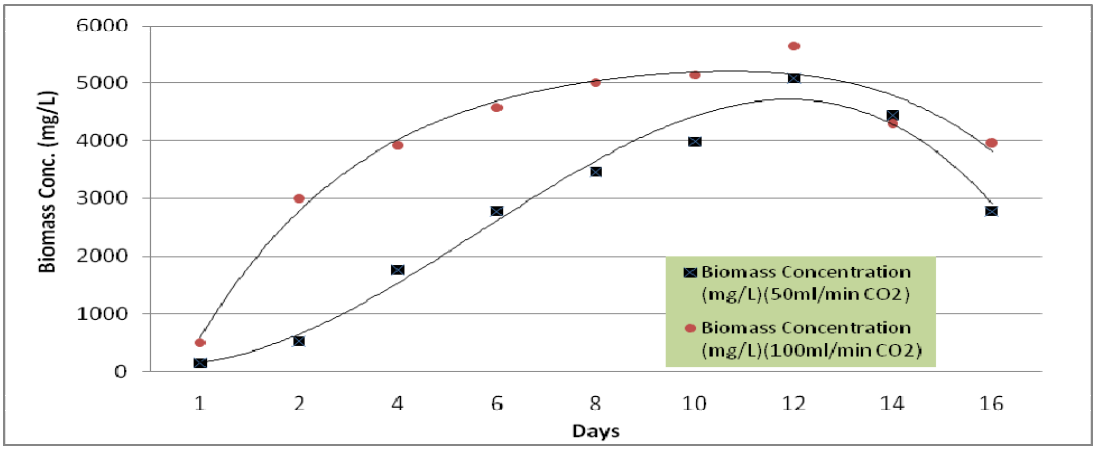


Figure 4. Comparison of biomass concentration (mg/ml) cultivated in two different CO_2 flow rate

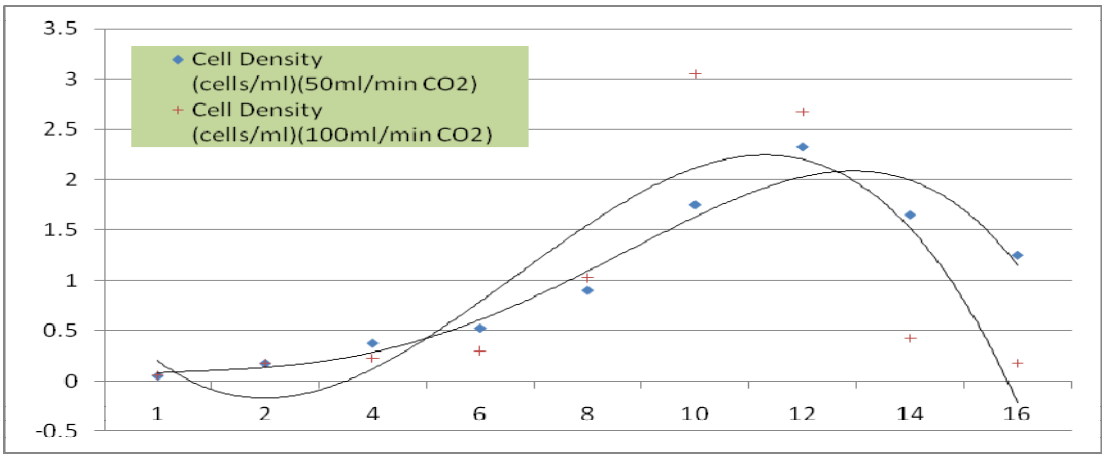


Figure 5. Comparison of cell density (cell/ml) cultivated in two different CO_2 flow rate

Therefore, even when the photosynthesis rate was higher, CO_2 was not the limiting factor for the microalgae growth. Since the above reaction produces hydrogen ion, the pH of the culture medium will become more acidic and may inhibit the microalgae growth. Based on the observation, when flow rate of CO_2 supplied into the photobioreactor is increased, the amount of biomass concentration and cell density is suggested to have slight increase. It is suggested pH level of the medium should be maintained in order to prevent the sudden drop in pH level due to high CO_2 flow rate but in this research the closed system photobioreactor does not uses automatic pH controller, the amount of pH cannot be regulated, thus leads to inhibition of *T.chuii* growth rate after 10th day as shown in figure 5.

CONCLUSION

The CO_2 flow rate have a slight effect on the biomass concentration and cell density where *T.chuii* cultivated in two different flow rate which is 50ml/min CO_2 have cell density 2.3×10^6cell/ml and biomass concentration 5080mg/L. A slight increase were observed when *T.chuii* cultivated at 100ml/min

CO_2 have higher biomass concentration and cell density which is 5640mg/L and 3.1×10^6cell/ml compared to *T.chuii* cultivated in 50ml/min CO_2. Based on the above result and analysis, the CO_2 flow rate may promote slightly better *T.chuii* growth rate but at the same time excess of CO_2 which is supplied to the microalgae culture without pH control system also contribute to the decrease in culture medium pH which eventually may inhibit the *T.chuii* growth rate. Therefore, it is suggested the microalgae cell density and biomass concentration can be increased with a proper system that can control the pH level in the photobioreactor and cultivation of microalgae using different pH level also should be considered.

ACKNOWLEDGEMENT

We would like to thank MOHE for providing FRGS (Fundamental Research Grant Scheme), for funding this research. We also would like to thank Institute of Bioscience (Marine Science & Aquaculture Laboratory), Universiti Putra Malaysia, UPM for allowing us to use some of the facilities were required to conduct this research and sharing some useful knowledge in microalgae research field.

REFERENCES

[1] Brennan, L., and Owende, P., 2010. "Biofuels from microalgae – A review of technologies for production, processing and extractions of biofuels and co-products". Renewable and Sustainable Energy Reviews. 14, 557-577.

[2] Cheng,L., Zhang,L., Chen, H., and Gao, C., 2005. "Carbon dioxide removal from air by microalgae cultured in a membrane-photobioreactor". Separation and Purification Technology. 50, 324-329.

[3] Chisti, Y., 2007. Biodiesel from microalgae. *Biotechnology Advances*. 25, 294-306.

[4] Edmund, J.M.Jr., 2009. Fundamentals of Water Chemistry for Marine Aquarists. *The Seawater Manual*. pp 9-11.

[5] Ghezelbash,F., Farboodnia.T., Heidari.R., Agh.N., 2008. *Research Journal of Biological Sciences*. 3(2): 217-221.

[6] Hossain, S., Salleh, A, and Boyce, A.N., 2008. Biodiesel Fuel Production from Algae as Renewable Energy. *American Journal of Biochemistry and Biotechnology* 4 (3):250-254.

[7] Granum,E., Myklestad.S.M., 2002. A photobioreactor with pH control: demonstration by growth of the marine diatom *Skeletonema costatum*. *J. of Plankton Research*. 24(6): 557-563.

[8] Pruvost. J and Vooren. G.V. 2009. Investigation of biomass and lipids production with *Neochloris oleoabundans* in photobioreactor. Bioresource Technology.

[9] Widjaja, A., Chien, C, C., 2008. Study of increasing lipid production from freshwater microalgae *Chlorella vulgaris*. *Journal of the Taiwan Institute of Chemical Engineers*. 40, 13-20.

[10] L.Barsanti and P.Gualtieri. 2006. Algae Anatomy, Biochemistry, and Biotechnology. In L.Barsanti and P.Gualtieri (Eds) *Algae and Nitrogen Cycle* 1st Ed., 164-168. United States. Taylor & Francis.

[11] Melinda J.G and Susan T.L.H, Lipid productivity as a key characteristic for choosing algal species for biodiesel production. *Journal of Applied Phycology,* 21 (5) 493-507.

[12] [12] Janarthanan.S, Surendran.K, Kumaran.P, Saifudin.N, *Study On The Effect Of Newly Developed Closed System Photobioreactor On pH Changes Of Microalgae (Tetraselmis chuii) Culture Medium*. Proceeding in International Conference on Advances in Renewable Energy Technologies. ICARET 2010-077.

Developing Heuristics for engagement of global mechanisms and local values in sustainable transition energy policy analysis

Ahmad Faizul Shamsudin[1] and Assoc. Prof. Dr. Amir Hisham Hashim[2]
[1]College of Graduate Studies, University Tenaga Nasional, Putrajaya, Malaysia
[2]Strategic Planning Dept., Corporate Planning Division, Tenaga Nasional Berhad, Kuala Lumpur, Malaysia

Abstract
This paper examines how the global mechanism of carbon reduction and local values (worldviews and intrinsic values) would have effects to transition energy paths for electric power supply. It adapts the multi-level perspective framework of transitions. Data mining method for heuristics or sets of "rules-of-thumb" from this framework identifies new, value-driven and sustainable development pathways carbon welfare and precaution levels in the local electric power supply industry.

Keywords
Transition energy, globalization, values heuristics

INTRODUCTION

The impact of global mechanisms of climate change negotiations and agreements (e.g., Kyoto, Berlin, Copenhagen) to local socio-political landscapes have been studied extensively [5]. These local socio-political landscapes include the background variables which are social values, worldviews and political culture [2]. This paper describes the use of the data mining technique of classification and association rules to derive heuristics from actors' choices and biases. It is based on the value-based transition energy policy analysis model [3] which is an adapted version of the multi-level perspective (MLP) framework for sustainability transitions [4].

THEORY

Value-based multi-level perspective (MLP) model for transition energy analysis

The growing gap between climate change rhetoric and reality in global climate change negotiations namely Rio, Kyoto , Berlin, Copenhagen suggest the need for a transition energy policy to be studied for power generation [5].

This study adapted the sustainability transitions theory [3]), comprising of socio-technical regimes, globalization, environmental governance perspectives etc. [4] .The current research gaps focus on the functions rather than the change and stability of a transition system [2]. Values comprising of worldviews [5] and intrinsic values [6] are proposed to produce the stability effects in the heuristic concepts of the multi-level perspective (MLP) model [5]. Humans use 'golden' rules or heuristics to guide through the uncertain world as their cognitive capacities are limited [7]. Two types of opposing heuristics are studied.

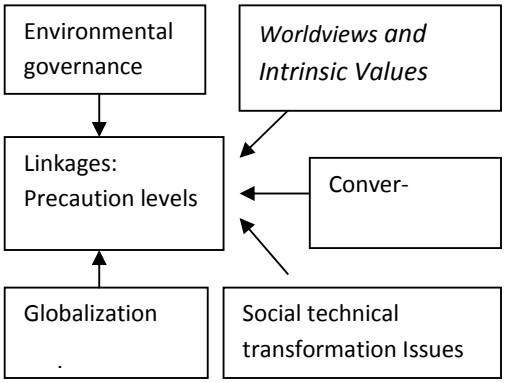


Figure 1. The star schema of MLP transition energy policy analysis model

Heuristics

One hypothesis in this study is the 'wise-choice' heuristics based on the notion of system intelligence with limited processing resources in making wise choices [4]. On the other hand, an opposing hypothesis in this study would be the availability heuristic [7] which suggests that people's subjective probability judgments of certain events are biased by the availability of consequences in memory. Both these hypotheses will be tested in this study.

METHOD

The initial step is to determine the 'real-world' attributes and their bases in the MLP model in FIG.1. The next step is to conduct a field study involving the multi-actors frame [3]. The frame consists of people who have the knowledge about the transition energy power plant candidates. In this study, the candidates are nuclear, coal, hydro and green (e.g. solar, biomass).

Actors

In order to obtain updated real-world data, between February to April 2010, a series of field studies were conducted amongst power plant and utility engineers (N=20) as 'knowledgeable' actors who

are working at and exposed to transition energy candidates of modern low-emission coal-fired power plant and hydro power plants.

Measure

The measure had about 40 attributes with rating scales from '1' to '10'. Datasets in ARFF format for data mining have these sample attributes;

@relation Transition Energy Analysis 2
@attribute Worldview econ1 numeric
@attribute Worldview econ2 numeric
@attribute Value intrinsic beauty nuclear numeric
@attribute Value intrinsic orderly nuclear numeric
@attribute GlobalR KyotoP Carbon welfare gain numeric
@attribute GlobalR UruguayR Carbon welfare gain numeric
@attribute Env Gov nuclear benefits numeric
@attribute Env Gov nuclear risks numeric
@attribute Conv transition nuclear pref rank numeric
@attribute Linkage nuclear precaution level numeric
@data

ANALYSIS & RESULTS

Manual computations of real-world data derived from the field study indicated classification and association rules from the attributes in relation to each other. The results in Appendix A.1. indicated classes of low, medium and high choices. The classification rules predict the classification of the nuclear power plant problem in transition energy analysis whether the precaution levels would be perceived high or low. It is possible that new rules could emerge that strongly associate different attribute values.

{Rule X4:
IF Econ Worldview = Mid AND Intrinsic Values = High
THEN Preference vote for nuclear = High AND Perceived Precaution Level = Mid
Rule X6:
IF Perceived Free Trade Carbon welfare gain = High AND Perceived Benefits = High AND Perceived Risks = High
THEN Perceived precaution levels for nuclear = High}

Simulations of biased worldviews and values produce the following effects; classification and association rules with biased low values produce less rules (Appendix A.2-b) compared to biased high values (Appendix A.2-c). However both biases produce less rules than the normal distribution of real-world data (Appendix A.2-a).

DISCUSSIONS

Globalization of carbon welfare

The results affirm the notion that the impact of the globalization issues of trade liberalization vis-a-vis to climate change are also dependent on the local socio-political landscapes of worldviews and intrinsic values. This is consistent with the effects of global trade agreements on the trends of per-capita carbon dioxide emissions in future [2]. This study found three basic rules of carbon welfare gains under free trades that would have important directions towards preferences for transition energy power plant candidates that are CO2 free. Previous study also found that globalization issues of free international trade would weaken the local environmental regulations [1].

Global precaution principles

The non-maximum precaution level indicates that actors are able to decide on levels of precaution that are between the minimum sum of costs of precaution and the maximum costs of unabated damages, in event of a major power plant accident. That is, the affordable costs to society that utility could afford the damages and that insurance company would underwrite the risks. Precaution rules fall into the low, medium and high classes. Each class of rules engages values and globalization perspectives.

CONCLUSION

Both the opposing availability and wise-choice heuristics are found in the natural and bias association rules. These provide the basis for generation of more hypothetical rules through data mining of transition energy policy analysis involving globalization issues of carbon welfare and precaution levels.

ACKNOWLEDGEMENT

The authors wish to thank University Tenaga Nasional and the International Islamic Univ. Malaysia for their kind permission to publish this paper. Last and not least the authors truly appreciate Prof. Dr. Cees J.H. Midden of Technische Universiteit Eindhoven (TUe) for his fine contribution in worldviews, values and heuristics concepts. It was part of the first author's postgraduate research at TUe.

REFERENCES

[1] Kuik, O. & Gerlagh, R. (2003). Trade liberalization and carbon leakage. *The Energy Journal*, Vol. 24, No. 3, International Association for Energy Economics, USA.

[2] Lanne, M & Liski, M. (2004). Trends and breaks in per-capita carbon dioxide emissions 1870-2028, *The Energy Journal*, Vol. 25, No. 4, International Association for Energy Economies, USA.

[3] Toss Gascoigne (2008). Climate Change – "The" Issue in the Australian National Election 2007? *Science Communication,* Vol. 29, No. 4, 522-531, Pg.524, Sage Publications.

[4] Berkhout, F., Angel, D. & Wieczorek, A.J. (2009). Sustainability transitions in developing Asia: Are alternative development pathways likely?. *International Journal of Technological Forecasting & Social Change,* Vol. 76, 215-217, Elsevier.

[5] Boelie Elzen, Frank W. Geels & Ken Green (2009). *Transition Management,* Edward Elgar, Cheltenham, UK.

[6] Jeroen C.J.M. van den Bergh & Frank R. Bruinsman (2008). *Managing the transition to renewable energy,* Edward Elgar, Cheltenham, UK.

[7] John Weyan (Ed.) (1999). *Energy and Environmental Policy Modelling,* Kluwer Academic Publishers, Boston.

APPENDIX A.1: RESULTS OF ASSOCIATION RULES

Nuclear power plant

High (10,9,8,7); Mid (6,5,4); Low (3,2,1)

Econ. WV	Intrinsic Value	Soc.	FTA Trans form	Benfits Carbon Wlfare Gain	Risks	Pref	Precaution Vote	Level	
1-High	High		High	Low	High		Low	Low	Low
2-High	High		High	Mid	Mid		High	High	High
3-Mid	Low		Mid	High	High		High	Mid	Mid
4-Low	High		High	High	High		High	High	High
5-High	Mid		High	Mid	High		High	Mid	High
6-High	Low		High	Mid	Low		High	Low	High
7-High	Low		High	Mid	Low		High	Low	High
8-High	Low		Mid	Mid	Low		High	High	Low
9-High	Low		Low	High	High		Mid	Low	High
10-Mid	High		Mid	Mid	High		High	High	Mid
11-Hig	Low		High	Low	Low		High	Low	High
12-Mid	Low		Mid	Low	Low		High	High	High

APPENDIX A.2a, 2b, 2c:. The Entity-Relationship Diagram of transition energy policy analysis for nuclear power technology ; - a.Normal distribution, -b.(Low Biases) and - c. [High Biases] of Worldviews and Values; Data mining correlation coefficients (α) are with Bayes probabilities, ρ = 0.6 to 0.7.

Developing IBS online survey system for CIDB

Maryam Qays*, Kamal N. Mustapha
Department of Civil Engineering, Universiti Tenaga National, Malaysia
*E-mail: sc20582@uniten.edu.my

Abstract

One of the most common techniques for collecting primary data is survey research. The traditional "paper-and-pencil" surveys have been used to collect primary data in different academic research fields for several years in spite of all the limitations of this approach. It has been proved that Web-Based Surveys could be considered as a serious alternative to the traditional "paper-and-pencil" format in all academic research fields. The popularity of online data collection methodology has increased recently in the advanced countries It is noticed that Construction Industry Development Board (CIDB) need to distribute questionnaire survey about industrialized building system (IBS) in Malaysia constantly. Therefore, the researchers have developed Online survey system to enable Construction Industry Development Board (CIDB) Malaysia to conduct and manage its on-line survey system hence avoiding the need for paper-based survey. With few clicks, a survey request can be developed and automatically transmitted to all companies which their e-mail addresses have been previously entered into the system which would allow respondents to reply via the web. Responses are then captured electronically by direct loading into a website database and analysis can be done with statistical software such as SPSS. The advantages of online survey system are very noticeable. This system can reduce employee time and effort on data compilation. It is also much easier and faster for client to complete the survey form. Postal mailing cost or printing cost would no longer be applicable. This system provides more efficient data and the low responses percentage can be improved.

Synthesis, Characterization and Bioactivity of Metal Complexes of Novel Phosphorous, Sulphur and Nitrogen-Containing Ligand Formed by Condensation Reaction of S-Benzyldithiocarbazate with (Triphenyl-λ5-phos phanylidene) acetaldehyde

Isam Hussain T. Al-Karkhi[a], M. Ibrahim M. Tahir*[a], Karen A. Crouse[a] and Rozita Rosli [b]
[a] Department of Chemistry, Faculty of Science, Universiti Putra Malaysia,
43400 UPM Serdang, Selangor, Malaysia
[b] Faculty of Medicine and Health Sciences, Universiti Putra Malaysia,
43400 UPM Serdang, Selangor, Malaysia
*Corresponding Author: Tel: (00603)89467489 / (00603)89466792.
E-Mail: mibrahim@science.upm.edu.my

Abstract

Novel phosphorous contain Schiff base ligands having nitrogen and sulfur donor ligand were synthesized by condensing S-benzylhydrazinecarbodithioate (SBDTC) with (Triphenyl-λ^5-phosphanylidene) acetaldehyde (TPPA) forming the novel Schiff base, benzyl(2E)-2-[2-(triphenylphosphanylidene) ethylidene] hydrazincarbodithioate (SBDTPA). Metal complexes of this ligand were prepared using Cu(II), Ni(II), Zn(II), Cd(II) acetate metal salt and Co(II) nitrate metal salts. These compounds have been characterized by a variety of physico-chemical techniques. The structure of nickel(II) and Co(III) complexes was proposed to be square planer structure, diamagnetic copper (II) complex shows a dimer structure while Cd(II) and Zn(II) proposed to have tetrahedral geometry. The Schiff base and its metal complexes were screened for antimicrobial and cytotoxic activity, it was found that cadmium complex shows more activity against microbes than other metal complexes. The complexes were also screened against cancer cell lines and it was found that some of the complexes were selectively active against MCF-7 (Human Breast cancer cells with positive estrogen receptor) and MDA-MB-231 (Human Breast cancer cells with negative estrogen receptor) cell lines with a IC_{50} values lower than 5.0 µg/ml, especially copper and cadmium complexes

Keywords

phenylhydrazinecarbodithioate, phosphorous Schiff base, PNS ligand

INTRODUCTION

Thiosemicarbazones of the heteroaromatic aldehydes and ketones are widely known as carcinostatic and antimicrobial agents (Lukevics *et. al.,* 2005) and a great A great attention was paid to thiosemicarbazides and their derivatives (Dutt *et. al.,* 1970 and Valdés-Martínez *et. al.,* 1989). The Coordination chemistry of nitrogen-sulfur donor chelating agents has mainly been studied with complexes containing transition metals (Ali *et. al.,* 1992 and Tarafder *et. al.,* 1989). These complexes are not only of importance for academic reasons but also many of these have already been tested in biological studies (Tofazzal *et. al.,* 2000). Iminophosphines are an interesting class of ligand due to the combination of the weak π accepting nature of the imine and the strong σ donor properties of the phosphino. (Simon *et. al.,* 2002)

The discovery physiological activity of entire group of organophosphorous compounds has evoked the increased attention of physiologists, physicians, veterinaries, agronomists, toxicologists, entomologists, and other representatives of the biological science. Arbozuv *et. al.,* 1960)

A new Schiff base, benzyl (2E)-2-[2-(triphenylphosphanylidene) ethylidene] hydrazincarbodithioate (SBDTPA) has been prepared by reacting S-benzyl dithiocarbazate (SBDTC) with (Triphenyl-λ^5-phosphanylidene) acetaldehyde (TPPA). The novel Schiff base was reacted with Ni (II), Cu(II), Zn(II) and Cd(II) acetate salts, and the Co(II) nitrate salt to yield metal complexes which were characterized using different physico-techniques. This is the first such dithiocarbazate derivative which contained phosphorus in addition to sulphur and nitrogen donor atoms.

METHODOLOGY

Preparation of the Schiff base benzyl (2E)-2-[2- (triphenylphosphanylidene) ethylidene] hydrazinecarbodithioate (SBDTPA)

SBDTC (0.01 mol) dissolved in 40 ml of hot 95% ethanol was combined with an equimolar quantity of (Triphenyl-λ^5- phosphanylidene) acetaldehyde (TPPA). (ethanol, 40 ml). Heating was continued until the clear yellow solution became turbid. The volume was reduced to half volume and refluxed for ~36h. Yellow precipitated after refridgeration overnight were filtered, washed with cold ethanol and recrystallized using a 1:1 mixture of acetonitrile and 95% ethanol. (Yield, 65 %. m.p 192 °C).

Preparation of Metal Complexes

M [acetate / nitrate].nH_2O [M = Cu(II), Ni(II), Co(II), Cd(II) and Zn(II)] (0.001 mol) dissolved in hot 95% ethanol (25 ml) was mixed with a solution of benzyl(2E)-2-[2-(triphenylphosphanylidene) ethylidene]hydrazincarbodithioate (SBDTPA) in acetonitrile / ethanol (1:1) (50 ml) and the resulting mixture was heated for ~30 minutes. On standing overnight, the mixture yielded crystalline complexes which were filtered, washed with cold ethanol and dried in a desiccator over anhydrous silica gel. Yields: *ca.* 55-70%.

Results and Discussions

A novel Schiff base, (SBDTPA) has been synthesized in condensation reaction as shown in figure 1.

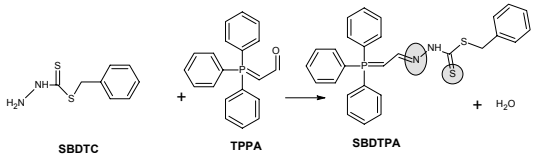


Figure 1: Condensation reaction producing SBDTPA

Reaction and characterization was achieved to SBDTPA and different transition metal ions complexes [Cu(II), Ni(II), Cd(II), Co(II) and Zn(II)]. The novel Schiff base was expected to coordinate with metal ions through the thiolo sulfur, the azomethine nitrogen while the phosphorous supposed not to be coordinated. After the synthesis and the characterization of the novel compounds using different physico-chemical analysis, bioactivity was screened against certain microbes (four types of bacteria and three types of fungus) table 1.

Table 1: Bioactivity Data of the SBDTPA Schiff bases and its Metal complexes

Compound	IC_{50} (µg/ml)	
	MCF-7	MDA-MB231
Tamoxifen	**7.1**	**8.5**
TPPA	53	74
SBDTC	12.0	8.8
Cd $(SBDTPA)_2$	**4.1**	32
Co $(SBDTPA)_2.NO_3$	Inactive	Inactive
Cu $(SBDTPA)_2$	**2.5**	**18**
Ni $(SBDTPA)_2$	Inactive	Inactive
Zn $(SBDTPA)_2$	Inactive	Inactive

* Results are in (mm), (Streptomycin 10 microgram), (Nystatin 0.5 miligram)
C.albicans – Candida albicans (C.A), *A.ochraceous – Aspergillus ochraceous* (398)
S.cerivisiae – Saccharomyces cerivisiae (20341), *MRSA* – Methicillin resistant *Staphylococcus B.Subtilis – Bacillus subtilis*- wild type (B29), *S.choleraesuis – Salmonella choleraesuis, P.aeruginosa – Pseudomonas aeruginosa* (60690) Weak - < 10 mm in diameter, Moderately active – 10 – 15 mm in diameter, Strongly active - >15 mm in diameter, - indicates 'not active'

Also cytotoxic activity was run to the novel compounds on two types of cancer cell lines (MCF-7 MDA-MB231), it was found that cadmium and copper complexes shows more activity than other complexes as shown in table 2.

Table 1: Cytotoxic Data of the SBDTPA Schiff bases and its Transition Metal complexes

IC50 < 5.0 µg cm^{-3}- strongly active, IC50 5.0 < 10.0 µg cm^{-3}- moderately active, IC50 10.0 < 25.0 µg cm^{-3}- weakly active, IC50 > 25.0 µg cm^{-3}- not active. IC50 (µg cm^{-3}) = Cytotoxic dose at 50% i.e. the concentration to reduce growth of cancer cells by 50%.

Complex	Bacterial Strains				Fungal Strains		
	MRSA	P. aer	S.cho	B. sub	C. alb	A. och	S.cer
SBDTC	19	30	-	25	26	17	26
TPPA	-	-	14	19	-	-	-
SBDTPA	-	-	**15**	**19**	7	7	-
Cd $(SBDTPA)_2$	-	8	**17**	**21**	12	11	**28**
Co $(SBDTPA)_2.NO_3$	**15**	10	**15**	12	-	-	**15**
Cu $(SBDTPA)_2$	14	12	14	**20**	**20**	**19**	**23**
Ni $(SBDTPA)_2$	**15**	**17**	**16**	**17**	**20**	**17**	13
Zn $(SBDTPA)_2$	-	-	13	11	-	-	-

ACKNOWLEDGMENTS

The Department of Chemistry, Universiti Putra Malaysia (UPM) and its technical staff are gratefully acknowledged for providing facilities and service. Sincere thanks to Ministry of Higher Education, Malaysia for the Fundamental Grant Scheme [01-01-07135FR].

REFERENCES

[1] Lukevics E, Jansone D., Rubina K., Abele E., Germane S., Shyrnanska M and Popelis J. *Eur J Med Chem* 30(1995) 983-988
[2] Valdés-Martínez J., Toscano R. A., Soriano-García M., Rubio M., Gómez-Lara J. and Vázquez M. A. -M. Polyhedron 8 (6)(1989) 727-73
[3] Dutt N. K.and Chakder N. C. J. Inorg. Nuc. Chemi. 32(7)(1970) 2303-231
[4] Ali M.A., Haroon C.M., Nazimuddin M., Majumder S.M.M.-u.-H., Tarafder M.T.H., Khair M.A. *Trans.Met Chem* 17 (2)(`1992) 133-136
[5] Tarafder M. H. And Rahim M. Ind. J. Chem .28A (1989) 1105.

[6] Tofazzal M., Tarafder H., Manaf A., Suhaimi M. Elias, Karen A. Crouse and Sidik Silong. Trans.Met Chem. 25(2000) 706-710

[7] Simon D., Julian G. K., Tom H. S., Mark R. J. E. and William C. *J. Organo. Chem.* 650(2002) 231–248.

[8] Arbozuv B. A. Bulletin of the academy of science USSR. 3 ((Moscow 1960). 103-105.

Simulation Analysis of a Foldable Carbon Fiber Reinforced Honeycomb Sandwich Composite Bridge

Agusril, Norazman M.N
Fakulti Kejuruteraan, Universiti Pertahanan Nasional Malaysia
Bangunan Bestari, Kem Sungai Besi, 57000, Kuala Lumpur, Malaysia
agusril@upnm.edu.my

Abstract
Simulation analysis of a foldable bridge using carbon fiber reinforced honeycomb will be presented in this paper. The foldable bridge is constructed using sandwich structure which is consisting of Carbon Fiber Reinforced Polymer (CFRP) and Aluminum Honeycomb as the skin and core, respectively. The reason to use the CFRP as a primary material is due to its high strength to weight ratio, thus making it lighter than steel and other alloy. The use of Aluminum Honeycomb Hex-Web 5.2-1/4-25(3003) is expected will increase the stiffness of bridge beam without additional weight significantly. Finite Element Analysis (FEA) is used to simulate several lay-up of CFRP layer including use of aluminum honeycomb core to increase stiffness of the member. The trials produce the maximum stress on the lamina (σ_1) = -104 MPa , (σ_2) = -4.02 MPa, and (τ_{12}) = -7.44 MPa, while the maximum stresses of aluminium honeycomb σ_z = 0 MPa, τ_{yz} = -0.844 MPa, τ_{xz} = 1.45 MPa. Failure analysis of CFRP and aluminium honeycomb show that the maximum stresses are in allowable material strength. From the trials can be concluded that, with proper design Carbon Fiber Reinforced Polymer and Aluminum Honeycomb can take the design load similar to steel and aluminium alloy.

Keywords
CFRP, Finite Element Method, Aluminium Honeycomb, and Foldable Bridge

INTRODUCTION

Bridges are needed to cross gaps to allow the transporter and human mobility. Recently, there is the research for portable bridge that usually used when infrastructure may have been badly damaged by conflict or natural disaster [1, 2].

Bridge is very important for mobility in military or civil emergency application. Recently, in Malaysia, a portable bridge has been used to open road for Bukit ANTARABANGSA landslides incident. The investigation of using composite material as bridge material [3-7] has been performed by many researchers. The results show that the composite material can be used as bridge material. The research of using fiber-reinforced polymer (FRP) composite in the construction of bridges provides an exciting alternative for engineers due to its high strength to weight ratio, which makes it an interesting alternative for the construction of bridge structure [8]. In general, FRP composite material has high stiffness and good fatigue resistance qualities. Relative to the steels, FRP posses better resistance to changes in temperatures, corrosions and chemical reactions. The density of FRP material about four times lighter than steel. These make the use of FRP more attractive as transporting, assembling and maintenance costs would be reduced. Fiber-reinforced polymer (FRP) has several favorable properties, such as high strength to weight ratio, corrosion-free characteristics, high degree of free formability and good fatigue resistance; it is the target material for the construction of portable bridges. Hundreds of pedestrian and several vehicular FRP bridges have been built, proving the feasibility of this material for lightweight bridges [9-12].

MATERIALS

The ASTM A-514 steel material as shown in Table 1 is used for the connection material of the bridge. The composite bridge is made from lamina which is consisting of 50% of carbon fiber tow sheet SK N-300 and 50 % of SKRS resin which is used as reinforcement and polymer, respectively. The lamina properties can be seen in Table 2.

Table 1. Properties of ASTM A514 Steel [13]

Physical Properties	Unit	Value
Density, ρ	kg/mm^3	7.9E-6
Elasticity constant, E	N/mm^2	210000
Tensile strength, Ultimate	N/mm^2	800
Tensile strength, Yield	N/mm^2	620
Poisson Ratio, v		0.3
Shear modulus	N/mm^2	80769

Table 2: CFRP Properties (Consist of 50% SK-N300 and 50% SKRS resin) [14]

Property	Unit	Value
Elastic Modulus 11	N/mm2	116200
Elastic Modulus 22	N/mm2	4750.4
Poisson's Ratio 12 = 13		0.290
Shear Modulus 12	N/mm2	1723.5
Density	kg/mm3	1.60E-06

DESIGN OF FOLDABLE BRIDGE

The first step in design of the beam is determining the type of military load class (MLC) as the critical vehicle loads, followed by calculating the critical moment and shear forces for the hinge design, and finally performing a detailed finite element analysis. CFRP Bridge beam is modeled and designed using DS CATIA V5 R18. The model will be analyzed using MSC PATRAN/NASTRAN finite element analysis software to

investigate the responses of structure. The portable bridge is consisting of two main beams with 30 m, 1.5 m and 1 m in length, width, and height, respectively. The beams consist of three sections. The sections are made in two types; flat and ramp section as may be seen in Figure 1. Each of section is connected using the connection which is called hinge. The hinge was design properly so that the bridge can be folded and flush with the top flange to ensure smoothness of the bridge deck.

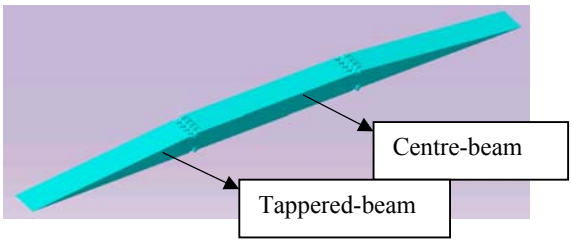


Figure 1: The bridge model with 3 sections

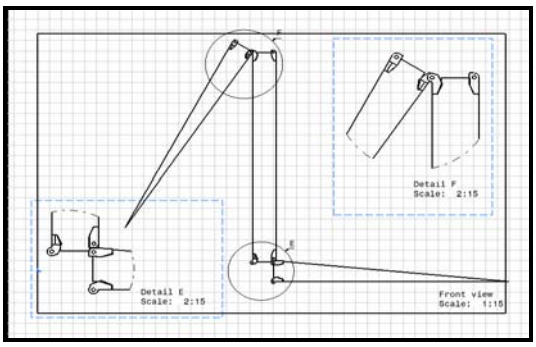


Figure 2: Foldable bridge system

The foldable bridge system is shown in Figure 2. The system which is focusing in connection design allows the bridge beam to be folded, thus making easy in transporting, handling and storing.

The entire of the bridge beam with the exception of the hinge is made from Carbon Fiber Reinforced Polymer (CFRP) and Aluminium alloy. The hinge was design by using steel material. The weakness in CFRP bridge design is excessive deflection at the mid span. Therefore honeycomb is used to reduce the deflection. The placing of honeycomb was investigated in this study to ensure that the core is placed at proper location.

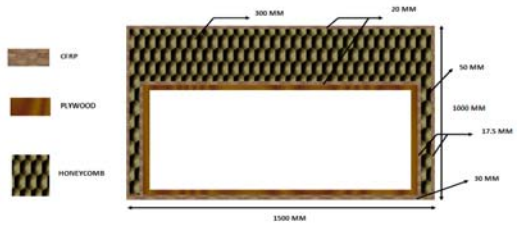


Figure 3 The location of honeycomb on the centre beam at the top flange and the web of beam section

The use of core structure at top flange of bridge can reduce the deflection significantly. While the placement of the core at the web section give slight improvement in reducing of deflection and web buckling. The core location can be observed in Figure 3.

Table 3: Lamina Sequence and Orientation in the Laminate

The part of structure	Sequence and orientation	Thickness (mm)	
		Laminate	Core
The top flange of ramp-section	$[90_1/0_{23}/\underline{\text{core}}]_s$	40	250
The bottom flange of ramp-section	$[90_1/0_{14}]_s$	25	0
The web of ramp-section	$[90_1/0_{17}/\underline{\text{core}}]_s$	30	150
The top flange of mid-section	$[90_1/0_{23}/\underline{\text{core}}]_s$	40	300
The bottom flange of mid -section	$[90_1/0_{17}]_s$	30	0
The web of mid -section	$[90_1/0_{20}/\underline{\text{core}}]_s$	35	50

Lamina sequences has important role in producing the stiffness of the bridge. With proper sequence of lamina in laminate will produce good stiffness, therefore minimized the deflection. The lamina sequences and laminate thickness can be observed in Table 3.

Finite Element Analysis (FEA)

Quadrilateral element four nodes (QUAD 4) are used in FEA. Laminate modeler facility is used to model the plies of lamina for foldable Bridge. CFRP and honeycomb material is considered as 2D orthotropic material in analysis. Failure criterion of Tsai-Wu, Maximum stress, Maximum strain and Tsai-Hill will be used to assess the failure of laminate.

Loads and Boundary Condition

For the purpose of this study, the loads were applied at the top-flange of bridge as shown in Figure 4. The loads are calculated according to TDTC [15]. In reality the bridge will be supported at the ends by embankment or compacted soil, with the length of 1000 mm from each end of the bridge rest on the support. These conditions were represented on the Finite Element Model as a pin and roller constraint at the support or embankment as shown in Figure 4.

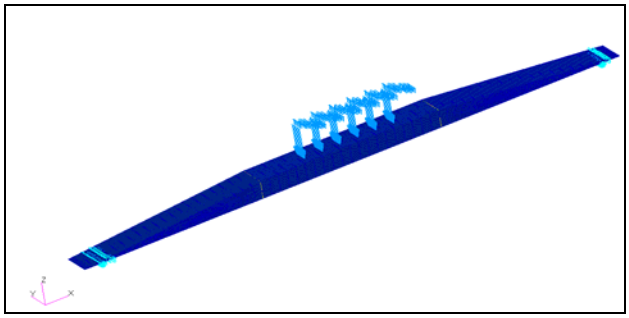


Figure 4: The load and boundary condition of bridge beam

Finite Element Analysis Results

Table 4 Maximum Stresses on the bridge structure

Property	Value	
	MPa	KSI
Stress in fiber-direction (σ_1)	-104*	-15.09
Stress in perpendicular to fiber-direction (σ_2)	-4.02**	-0. 58
Shear stress (τ_{12})	-7.44*	-1.08

FEA results can be observed in Table 4. Failure of foldable beam needs to be investigated to ensure that the stress of beam in the allowable strength of material as shown in Table 5.

In the failure analysis as shown in Figure 5, the stresses of structure still within the allowable range, it means that the structure will not fail in the operation. The graphs are generated from formulation that involves the maximum stresses and the strength of material as shown in Table 4 and 5.

Table 5 Strength of carbon fiber reinforced polymer (CFRP) [16]

Property	Value	
	MPa	KSI
Tensile strength in fiber-direction (X_t)	1219	176.84
Tensile strength in perpendicular to fiber-direction (Y_t)	18	2.65
Compressive Strength in fiber-direction (X_c)	1219	176.84
Compressive Strength in perpendicular to fiber-direction (Y_c)	18	2.65
Shear strength (S)	70	10.20

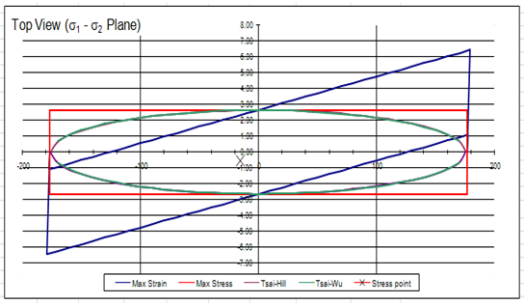


Figure 5 Failure criterion graphics in KSI unit [16]

Table 6 Strength of Aluminium Honeycomb Hex-Web 5.2-1/4-25(3003)

Property	Value	Description
σ_z	4.6	Stabilized Compression (Z)
τ_{yz}	2.4	Longitudinal Shear Strength (L)
τ_{xz}	1.5	Transverse Shear Strength (W)

Table 7 Failure analysis of aluminium honeycomb

Responses		Value		Description
Locations		Stresses	Strength	
Maximum Stresses	σ_z	0	4.6	Ok
	τ_{yz}	-0.844	2.4	Ok
(MPa)	τ_{xz}	1.45	1.5	Ok

Failure analysis of honeycomb material needs to be investigated to ensure that the honeycomb stresses in the allowable strength of the material. Table 6 show the strength of honeycomb which is obtained from supplier brochure [17]. Maximum stress on the honeycomb as shown in Table 7 is obtained from static analysis of foldable bridge. From the comparison between stresses and strength as shown in Table 7 can be observed that the stresses in honeycomb are lower than the strength of honeycomb itself. It means that the honeycomb is able to support the load without failure.

CONCLUSION

From the study done, we can conclude that, CFRP and Aluminium honeycomb, can be used as main material for the foldable bridge without failure on the bridge structure. The core thickness and CFRP sequence has to be determined properly to obtain optimum strength.

ACKNOWLEDGMENTS

The authors are grateful to *Universiti Pertahanan Nasional Malaysia* (UPNM) and Ministry of Science, Technology and Innovation (MOSTI) Malaysia for support and finance provided to this research project.

REFERENCES

[1] Wight, R. G., Erki, M. A., and Heffernan, P. J. (2002) Canadian federal interest in FRP for structures. Struct. Eng. Int. (IABSE, Zurich, Switzerland), 12(2): 99–101.

[2] Wight, R. G., Erki, M. A., and Heffernan, P. J. (2003) FRP for structures in support of construction engineers of the Canadian Forces. Proc., Canada–Japan Workshop on New Applications of Advanced Composites, 185–192.

[3] Wight, R. G., Shyu, C. T., Tanovic, R., Erki, M. A., and Heffernan, P. J. (2004a) Short-span deployable GFRP tapered box beam bridge. Proc., 4th Int. Conf. on Advanced Composite Materials in Bridges and Structures (CD-ROM), 20–23.

[4] Wight, R. G., Shyu, C. T., Tanovic, R., Erki, M. A., and Heffernan, P. J. (2004b). Deployable tapered box beam bridge. Advanced Polymer Composites for Structural Applications in Construction, L. C. Hollaway, M. K. Chryssanthopoulos, and S. S. J. Moy, eds., Woodhead Publishing, Cambridge, England, 428–433.

[5] Wight, R.G., Erki, M.A., Shyu C.T., Tanovic R. and Heffernan, P.J. (2006) Development of FRP Short-Span Deployable Bridge-Experimental Results. J. Bridge Eng., © ASCE / **Jul/Aug**, 489-498.

[6] Robinson, M. J., Kosmatka, J. B. (2008) Development of a Short-Span Fiber-Reinforced Composite Bridge for Emergency Response and Military Applications. J. Bridge Eng., © ASCE / **Jul/Aug**, 388-396.

[7] Sedlacek, G., Trumpf, H., and Castrischer, U. (2004). "Development of a light-weight emergency bridge." Struct. Eng. Int. (IABSE, Zurich, Switzerland), 14(4), 282–287.

[8] Latif, Abdul. Zainuddin, & Hassan, Abu. (2005). Finite Element Analysis and Experimental Tests on UTM Composite Bridge. FKM, UTM Skudai, Johor, Malaysia.

[9] Weaver, A. 1997. "Kolding Bridge: A technical landmark." Reinforced Plastics, 41(8), 30–33.

[10] Keller, T. (2002). "Overview of fiber-reinforced polymers in bridge construction." Struct. Eng. Int. (IABSE, Zurich, Switzerland), 12(2), 66–70.

[11] Johansen, G. E., Wilson, R., Pope, D. A., Goss, G., Ritchie, P., and Mellen, J. (1992). "Spanning 'Devils Pool' with a prestressed cable/FRP tube structural system." Proc., Advanced Composites Materials in Bridges and Structures, Canadian Society for Civil Engineering, Montreal, 435–444.

[12] Johansen, G. E., et al. (1996). "Design and construction of two FRP pedestrian bridges in Haleakala National Park, Maui, Hawaii." Proc., Advanced Composites Materials in Bridges and Structures, Canadian Society for Civil Engineering, Montreal, 975–982.

[13] Matweb (2010) Physical properties of Steel ASTM A 514 Grade P, http://www.matweb.com. (Accessed: January 2010)

[14] Agusril (2009) Design portable bridge system using composite material. Master Thesis, National Defence University of Malaysia (NDUM), Kuala Lumpur, Malaysia.

[15] Trilateral Design and Test Code for Military Bridging and Gap-Crossing Equipment. Appendix A-2, January 1996.

[16] Greg Kress. (2008). Material Library from ABARIS training.

[17] Hexcel composite. (2000). Honeycomb sandwich design technology. [Brochure]. Stamford: Hexcel Composites.

Emissions Estimate Profiling Methodology from Marine Vessels

Daarulmuqaamah Masaud and Heman Buang*
Science and Technology Maritime Department
Faculty of Science and Defence Technology,
National Defence University of Malaysia,
Kem Sungai Besi, 57000 Kuala Lumpur, Malaysia
*Corresponding author email: heman@upnm.edu.my

Abstract
Emissions from ports are considered to be major sources of oxides of sulphur (SO_x), oxides of nitrogen (NO_x), carbon dioxide (CO_2) and particulate matter (PM). It is important to stress the significant of the damage from exhaust emissions to human health and environmental performances. The paper presents a methodology to estimate the emissions from ships exhaust and develop emissions inventory which provides information to track the performance of emissions estimate operation over time. Emissions are calculated by multiplying fuel consumption to emission factors and operation hours. Emissions test will be performed at different operations of engines load: normal cruise, low-speed cruise, maneuvering and hotelling. Through this, we are able to understand and manage the air pollutant emissions exhausted from ship of current port operations.

Keywords
Ship exhaust, emission factor

INTRODUCTION

The research originates from the realization of air pollutants emitted from marine vessels, which mostly significant with growing shipping industries. Most of marine vessels are powered by diesel engine and studies were showing that fuel diesel engine has degraded air quality which mainly due to the higher sulphur content in fuels [1]. Increasing the number of navigating vessels adds to environmental problems and human health in surrounding areas.

Therefore, this paper aims to describe a methodology in preparing emissions inventory[1] for port authorities and estimate the emissions of ship based on fuel consumption and fuel quality. The calculation of gas emissions (SO_x, NO_x, CO_2 and PM) exhausted from industrial and enforcement ships are conducted to evaluate the emissions by different level of operations. Generally, in emission inventories, emissions are determined by applying emission factors to port activity, statistically. Emission factor is an emission per unit of energy from engine in a particular activity [2]. To provide confidence on the validity of emission factors, emissions test on each engine load[2] will be examined. However, emission factors are adjusted using conversion factor[3] to meet the accuracy of real-local situation. It should be noted that all the emissions calculation carries an uncertainty of level to the validity of emissions values.

METHOD AND MATERIALS

Emission inventory generated from the specification of ship characteristic, fuel profiles, engine profiles and ship activity. Source of data collection derived from shipping records, marine exchange from local port authorities, qualitative information on how the vessels are used in service and the observation on ship activities. Emissions calculations were adopted from Trozzi and Vaccaro [3] methodology by multiplying fuel consumption with emission factors and vessel activity for each type of ship. The equation presented as:

$$E_i = S_{jklm} \times E_{ijklm} \quad (1)$$

$$S_{jkm}(GT) = C_{jk}(GT) \times p_m \quad (2)$$

$$E_{ijklm} = S_{jkm}(GT) \times t_{jklm} \times F_{ijlm} \quad (3)$$

Where i is the pollutant type, j the fuel type, k the ship class, l the engines type, m the mode operation, E_i the total emissions of pollutant i, E_{ijklm} the total emissions of pollutant i from use of fuel j on ship class k with engines type l in mode m, $S_{jkm}(GT)$ the daily consumption of fuel j in ship class k in mode m as a function of gross tonnage, t_{jklm} the days in navigation of ships of class k with engines type l using fuel j in mode m, F_{ijlm} the emission factors of pollutant i from fuel j in engines type l in mode m (for SO_x, taking into account average sulphur content of fuel), $C_{jk}(GT)$ the daily consumption at full power of fuel j in ship class k as a function of gross tonnage and p_m the fraction of maximum fuel consumption in mode m.

---

[1] Emission inventory is a quantification of all the pollutant emissions criteria that included in the study area and specified by their sources.

[2] Engine load is referred to the actual power output of the vessel's engine or generator

[3] Conversion factor is used to adjust emissions or other situations for nonstandard conditions to reflect the evaluation of real situations.

Emissions test samples will be performed under steady-state conditions and the fuel samples needed to determine the sulphur content. The research is focused on four operating modes: normal cruise, low-speed cruise, maneuvering and hotelling. The main engines will be tested at normal cruise, low-speed and maneuvering but the auxiliary engines requires test at hotelling modes only. SO_x, NO_x and CO_2 are measured as continual sampling based on automatic gas analyzers to determine concentration in the dry exhaust gas. PM samples are relied on grab samples using a partial flow dilution system in the given particular time period [4]. Exhaust emission factor is then calculated by using conversion factor according to the sulphur content of the fuel in kg pollutant per ton of fuel [5]. The emissions can be obtained by calculation of all parameters and forecasts the result within marine regulation.

PROPOSED EMISSIONS EVALUATION

In emission inventory, ship profiles will be distributed into type of ship and exhaust, ship size, dead weight tonnage, gross tonnage and maximum ship speed. The fuel profiles consist of fuel type, total of fuel use per day, sulphur content, fuel correction factor and specific fuel consumption information. The engines population will be broken down into engine type, model, age, power and speed. For ship activity involves different engine load operations such as cruising where it is considered using 94 percent of maximum speed and 83 percent of maximum continuous rated engine power (MCR), maneuvering where ship arriving at or departure from the dock and hotelling when ship arrival in port continues to emit at the dockside [2]. This activity is specified by fuel consumption in each ship type and operation hours. As in equation where fuel consumption as a function of gross tonnage (GT) is to evaluate the considerable relationship between fuel used and ship volume [6]. Fuel quality and engine type can contribute a bigger impact on emission factor values.

In SO_x emissions calculation, SO_x emission factor is calculated according to the sulphur content in the fuel. Sulphur Dioxide (SO_2) and Sulphur Trioxide (SO_3) are referred as SO_x. When the fuel burnt, the sulphur expected to be oxidized primarily as SO_2 and in small amount as SO_3 [7]. The calculation involves molecular weight and the factor converting the emissions mass from Sulphur (S) to SO_2. Meanwhile, CO_2 emissions are calculated from the reaction of hydrocarbon in fuel combustion with Oxygen (O). Alike SO_x, CO_2 emission factor is expressed in the same way. NO_x and PM emission factor is highly dependent on characteristic of engine and fuel [7]. The different of engine duty cycle should be considered in NO_x and PM emissions values because of some vessels can perform in optimal operation with good fuel efficiency. Also, some reduction technology which installed to the vessels should be taking into account in evaluating the emission. The accuracy of emission factor from other studies can be applied to the similar sector but it is preferable to acquire emission factor that reflect to the real situation by direct measurement [8].

CONCLUSIONS

This research can expand the knowledge to get a better understanding about the process in developing estimation methodology for air emission inventory. It then can allow the other ports and government agencies to implement these methods in order to develop control strategies of local air quality. However, it is difficult to define the air pollution to be acceptable in international standard levels, mainly because of poor data sources to be used in air pollution studies.

ACKNOWLEDGEMENTS

The authors would like to thank all individuals and organizations involved in this research, Faculty of Science and Defence Technology, National Defence University of Malaysia, for their invaluable help.

REFERENCES

[1] Corbett, JJ. 2004, Verification of ship emission estimates with monitoring measurements to improve inventory and modelling, Final Report, Prepared by University of Delaware.

[2] EPA, 2009, U.S. Environmental Protection Agency, Current methodologies in preparing mobile source port-related emission inventories, Final Report, Prepared by ICF International, 09-024, April 2009.

[3] Trozzi, C. & Vaccaro, R. 1998. Methodologies for estimating air pollutant emissions from ships, 22nd CIMAC International Congress on Combustion Engines, Copenhagen 18-21 May 1998.

[4] Cooper, D. A. *Atmospheric Environment* 35 (2001) 4189-4200.

[5] EPA, 2000, U.S. Environmental protection agency, analysis of commercial marine vessels emissions and fuel consumption data, Prepared by Energy And Environmental Analysis, February 2000.

[6] Hulskotte, J. H. J., & Denier van der Gon, H. A. C. *Atmospheric Environment* 44 (2010) 1229-1236.

[7] Olivier, J. P. *J. Nav. Eng*. 44(2) (2008) 317-344.

[8] Emission Inventory, 2009, What is an Emission Inventory, online, retrieved October 2009 from http://www.adorc.gr.jp/wei_doc/emissioneng.pdf.

The Design of Telescopic Bridge Launching System

M.Hakimi[1],*, Norazman Mohamad Nor[1]
[1]Universiti Pertahanan Nasional Malaysia
*kimisawa86@yahoo.com

Abstract
This research is about improving the designed launching system concept of a Portable Telescopic Bridge. Portable bridge which is famously known as army/ military bridge often used for assault operation during war since World War II and become an asset during disaster relieve operation. The research on the development of a Telescopic Bridge in Malaysia has been done previously since early 2000. Their researches however are focusing more on the conceptual design and the material strength of the telescopic bridge structure. The research that will be conduct later will improve some of the Telescopic Bridge design and develop the launching system of the bridge. The proposed launching system would be the integration of the hydraulic system in crane industries into the bridge application. The capability of conventional cylinder and telescopic cylinder will be analyse and then compare which is most suitable to be use in the hydraulic launching system. Besides the launching system, the internal locking system to hold the boom segments also will be designed. In the end the launching system and the locking system prototype will be developed.

Keywords
Bridge, Telescopic, and Hydraulic

INTRODUCTION

There are differences between each type of such bridge in term of launching system (eg; cantilever launching method with human power, foldable and unfold using hydraulic launcher and modularity), material, sizes, weight, and etc depending on the needs and its requirement. The existing bridges which are famously use in the market are LEGUAN Bridge layer, PAR 70 Support Bridge, PFM Floating Bridge, Bailey Bridge, Medium Girder Bridge, and General Support Bridge BR 90. Comparisons on some properties of the bridge gather from [1] are shown in Table 1 below. The existing Telescopic Bridge propose by previous researcher has been design to be operated telescopically. Some of the bridge main components mention by previous researcher is Clevis Rod and Cotter Pin, retention cable and launching rail. However, some modification and addition will be made to improve the bridge existing concept. Figure 1 shows the CAD conceptual drawing of Telescopic Bridge from [2].

Table 1: Comparisons between bridges

Properties / Bridges	Military Load Class	Launching System	Length (m)	Launching time (minutes)
LEGUAN Bridge Layer	70 / 80	• Using AVLB or tank chassis as bridge launcher • Fully automatically launch • Electronically control • Foldable	25	5-7
PTA Modular Assault Bridge with 3 modules	70	• Foldable	27	7
Class 30 Medium Assault Bridge (MAB)	30	• Foldable	22	10
PAR 70 Support Bridge	70	• Foldable • Hydraulic system	19.5	6
Panzerschnellbrücke 2 (PSB 2)	70	• Foldable	27.7	6
Bailey bridge,	N/A	• Cantilever Launching Method and human force	60	N/A
Medium Girder Bridge (MGB)	60	• Push Launch and Jack Launch Method	30 - 76	45 minute (for 30 m)
BR 90 General Support Bridge	70	• Rail Launch Method • Modularity	16 - 52	N/A

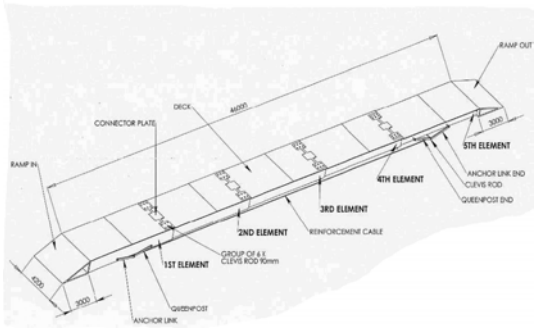


Figure 1: The picture of the combat bridge fully launches.

Problem Statement

The Telescopic Bridge launching system should be simple, less electrical mean to avoid problem during disaster involving wet condition, and able to withstand the structural load which distributed from the load applied to the bridge beam. The bridge has been proposed to be hydraulically launched because of the large power or energy can be supplied by hydraulic. The concept of hydraulic cylinder application in crane will be use as reference in the Telescopic Bridge whereby the hydraulic cylinder located between the bridge segments as shown in Figure 2 from [3]. The usage of telescopic cylinder

as the piston-cylinder unit will gain significant improvement on the boom extension length. However, the telescopic cylinders as shown in Figure 3 usually are used in tipping truck and have not been used in bridge industry so far, also it is constraint to six stages maximum without any support. The other main part in this research is to discover the best way to lock/ hold or stop the boom segment at full extend condition. In crane industries, an electrically operated internal lock has been used to hold the boom segment from moving as mention by [4].

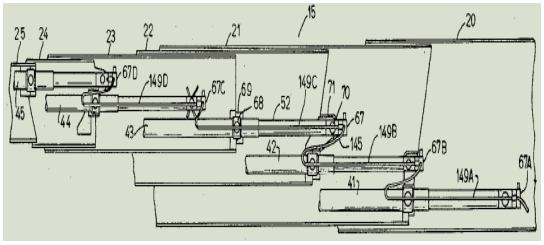


Figure 2: Picture of hydraulic system concepts in one of the patented crane telescopic boom.

Figure 3: Telescopic cylinder

METHODOLOGY

The launching system will be designed graphically using CAD software and the hydraulic circuit for the bridge launching will also be developed. The implementation of the telescopic hydraulic cylinder instead of the standard hydraulic cylinder will be tested and analyse. The prototype of a hydraulic launching system will be developed on a single open surface to enable the bridge telescopically launching process and sequence being observed. The internal locking system prototype will be produce and implemented to the launching system prototype. The prototypes developed will be scale down to a lab scale to simplify the transportation and analysis purpose.

CONCLUSION

In the end of the research, the telescopic cylinder can be used to replace the conventional hydraulic cylinder for extension and retraction operation as expected earlier. The lock designed and fabricated is able to hold the boom segment from derail during the launching operation.

ACKNOWLEDGEMENT

The authors are grateful to **Ministry of Science, Technology & Innovations** Malaysia (MOSTI) and Universiti Pertahanan Nasional Malaysia for their financial support and other assistance in this research.

REFERENCES

[1] Agusril. Design Portable Bridge System using Composite Material. Slide presentation at UPNM Post Graduate Students Colloquium. 13 April 2009.

[2] Azrul. Affandhi Bin Musthaffa Al Bakri., "Rekabentuk Jambatan Tempur: Rasuk Utama dan Simulasi Pelancaran Jambatan", B.Eng Thesis, University of National Defence Malaysia, Kuala Lumpur, Malaysia (2007).

[3] Johnston et al., "Hydraulic Cylinder for Telescopic Boom", United States Patent (1973).

[4] Bröckelmann et al., "Hydraulic Cylinder for Telescopic Boom", United States Patent (2003).

[5] Hafizullah Noor bin Mohd Sallehuddin, "Jambatan Mudahalih: Kajian Penggunaan Bahan Komposit GFRP Sebagai Rasuk Utama", B.Eng Thesis, University of National Defence Malaysia, Kuala Lumpur, Malaysia (2008).

[6] Norazman Mohamad Nor et al., "Fiber Reinforced Polymer (FRP) Portable Bridge: Modelling and Simulation", European Journal of Scientific Research. (2010) 437-448.

Development of Fibre-Reinforced Polymer Composite as Innovative Structure in Portable Bridge

Syazwan Ahmad[1], Norazman Mohamad Nor[2] and Agusril[3]
[1,2,3]Department of Civil Engineering, Universiti Pertahanan Nasional Malaysia,
Sg. Besi Camp, 57000 Kuala Lumpur, Malaysia.
syaz@upnm.edu.my

Abstract
In this paper, the use of fiber-reinforced polymer (FRP) as advanced material in bridge structures is reviewed, focusing on the developmental effort to produce alternative portable bridging system which is safe and lightweight with reasonable cost. The paper includes a description of ongoing current research work on design and finite-element analysis with comparable result to recent similar research done for the US Army. Current author's research work is heading to further continue recent development and interest on producing lightweight bridging systems, adopting FRP composite as the innovative element at design and fabrication stage.

Keywords
Composite materials; Fiber reinforced materials; Polymers, Military engineering

INTRODUCTION

Advanced materials such as aluminum alloy are finding wider acceptance, known for the high strength-to-weight ratio, resistance to corrosion, high thermal and electrical conductivity, and their ease for formability and machinability. As the cost continues to decrease, such material are replacing conventional material such as heavier steels, namely in containers and packaging (aluminum cans and foils), in buildings and other types of construction, in transportation (aircraft and aerospace applications, buses, automobiles), in electrical appliances (economical and non-magnetic electrical conductor), and in consumer durables (appliances, cooking utensils) [1].

Modern civil structures, such as bridges, have seen successful adoption of such material in past decades particularly in the design and fabrication of portable bridges, mainly due to its lightweight and corrosion-resistance properties [2]. Portable bridges were famously deployed during war times by military forces, where the rapid deployment of such bridge is critical to open up ground line of communications by bridging wet and dry gaps. Such lightweight aluminium structure requires less equipment and manpower to transport and deploy, which is critical factor in mobility on the battlefield. Nowadays lightweight portable bridges found it uses in the aftermath of natural disaster, where save and rescue operations are carried out more effectively.

Recent development has strongly implied that fiber-reinforced polymer (FRP), as the leading material technology in bridge construction [3]. FRPs' advanced qualities, namely high strength-to-weight ratio, non-corrosive characteristics, and fatigue resistance, make it an attractive construction material. FRP composite materials were introduced in civil and transportation infrastructure applications in the 1950s as specialized alternative measures for reinforcing concrete. Since the 1980s, FRP materials have received considerable attention as both internal and external reinforcing materials primarily for concrete structures. Since the mid-1990s, FRP structures have been introduced as viable systems for use in civil and transportation infrastructure applications.

FRP composite as bridge structure

FRPs are currently being adopted in new bridge construction as an alternative material for corroded bridge deck replacements. FRP bridge decks are attractive because of their minimal installation time and high strength-to-weight ratios. Their light weight, and thus reduced dead load, is particularly attractive for rehabilitating posted structures, since replacing heavy conventional concrete decking with lighter-weight FRP decking may translate to additional live-load carrying capacity of the bridge system [4]. Development of FRP deck replacement projects in the US is being funded and monitored by the Office of Bridge Technology, US D.O.T. - Federal Highway Administration, which demonstrate the organized efforts by authorities to further support the advancement of FRP composites into conventional practice [5].

In general, FRP use as a structural material in bridge construction may be grouped into three main areas; rehabilitation and retrofit, reinforcement for concrete and new fibre-reinforced composite structures. Despite the considerable success of these materials in rehabilitation and retrofit they have enjoyed little success as new fibre-reinforced composite civil structures.

Bridge structure, such as beam can be designed to be light and foldable, which is an important asset for mobility in any military operations especially in the

war zone. It is needed by the combat engineers for certain vital task i.e. to bridge obstacles or gaps, such as river, valley, or lake. Foldable beam is portable, thus, is vital element for the combat engineers to repair or replace existing bridge destroyed by enemy during war. Furthermore, such portable structural element can also be urgently needed in disaster areas to open ground line of communication cut off due to flood, hurricane, tsunami, landslides, earth quake or various other disasters. International nongovernment organizations (NGOs) have an intense interest in cross-country mobility where infrastructure may have been badly damaged by various incidents, conflict or natural disaster. The foldable beam system can also be use for various other needs such as to build shelter, bunkers, and to cover damaged road surface.

Recent development

The increasing need for portable bridges for military and civilian applications, which are lightweight and inexpensive, have prompted studies of the use of FRP as innovative structural system in portable bridge, taking advantages of flexibility in FRP beam design. FRPs application as integral structure in portable bridge is relatively new, although there are several active researches being done in number of countries. In "Development of FRP Short-Span Deployable Bridge—Experimental Results," Wight et al. [6] describe a glass FRP bridge system being designed for use by Canadian Forces to be rapidly deployable and lightweight while having a high load-carrying capacity. The prototype bridge consists of treadway fabricated from commercially-available pultruded fiberglass tube sections and sheets which are bonded together to form a tapered box beam which is 4.8 m (189 in.) long and 1.2 m (48 in.) wide. Based on the experimental study of the prototype box beam, a full-scale 10-m FRP bridge is presently being constructed that should support an MLC 30 (27,000-kg) vehicle.

In the US, polymeric-composite mobile army bridge has been developed for the US Army since 90's that will have greater tactical mobility (rapid deployment/retrievals, carry multiple bridges per launcher, minimum profile depth), as well as weigh less and cost less, than existing metallic bridges. The bridge, known as Composite Army Bridge (CAB) proved to be a lighter alternative to existing bridging systems of the same load class and to date has experienced 20,000 actual or simulated crossings with no signs of damage [7], which was capable of crossing gaps up to 12.2 m (40 ft) in length while supporting track and wheeled vehicles up to MLC 100 (90,700 kg, 200,000 lbs). Based on the success of CAB program, Robinson and Kosmatka [8] reported futher development of completed design and fabrication of the new bridge treadways, full scale proof testing of the treadways, and field testing using a fully loaded PLS truck which shows the bridging system to satisfy the design requirements and to have sufficient strength to support MLC 30 and PLS truck vehicles.

OBJECTIVE OF RESEARCH

Research is being undertaken at UPNM as primary national defense university with main motivation to produce alternative, advanced bridging system that is portable, lightweight, require less equipment and manpower to transport and deploy. Recent thesis by Agusril [10] dealt with conceptual design of an MLC70 3-sections foldable bridge with analysis of load cases being done using finite-element analysis. The current research aims to fabricate a 1:5 scaled prototype foldable beam and to develop experimental procedures to investigate the static and dynamic performance of the beam.

RESEARCH METHODOLOGY

Load Requirement

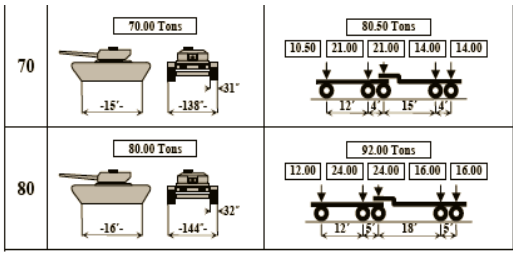
The design of the bridge system is outlined in the Trilateral Design and Test Code for Military Bridging and Gap-crossing equipment TDTC 2005 [9]. The TDTC is a design and test code for military gap-crossing equipment which was developed through a cooperative effort between the United States, Germany, and the United Kingdom. The intent of the code is to provide a common set of design and testing procedures as well as requirements which allows equipment (bridges) tested in one country in accordance with the TDTC to be suitable for international acceptance.

A discussion of the Military Load Class (MLC) according to Hornbeck *et al.* [9] is required, as it determines that loads at which the model analysis and testing should be performed. The MLC is a number that is applicable to both the vehicles and bridges. The MLC represents the load rating of the vehicle, as well as the design capacity of the bridge. The vehicle rating is compared with the design capacity to determine whether the vehicle can safely cross the bridge. For example, hypothetical MLC 70 and 80 Vehicle (US Units) is shown in Table 1.

The bridge MLC is dependent mainly on the vehicles that the bridge will be designed to sustain. Once the bridge has been designed, it then undergoes three tests to qualify the bridge for the MLC and span:

- Working Load: the load (vehicle load + dynamic factors) that the bridge will carry;
- Overload: the bridge's working load multiplied by a safety factor of 1.33
- Ultimate Load: the bridge's working load multiplied by a safety factor of 1.5

Table 1. Hypothetical vehicles for military load classes



Thus, the intended design requirements are: (1) The bridge beams must be light enough to be handled using small crane or special launching equipment on the transporter; (2) the beam needs to support the military load class (MLC) 70; (3) the beam must be able to fold for easy in handling, transporting and storing; (4) the maximum deflection of the beam is limited to 150 mm at the mid span; (5) a minimum safety factor of 1.33 and 1.5 shall be maintained

Beam Design

Following conceptual design study done by Agusril [10], the full scale bridge consists of two tapered section, and one mid section (Figure 1). The dimensions are 30 m in length, 1.5 m width, and 1 m height. However, the constant height is only applicable to mid-section, while the height of tapered section will decrease to 100mm at one end.

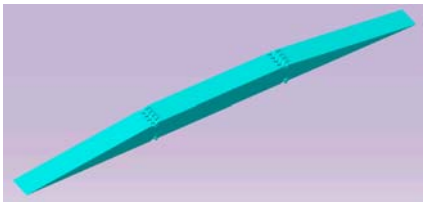


Figure 1. Foldable beam. Mid & ramps sections

Figure 2 shows the cross-section of the bridge beam. The bridge beam in shaping of rectangular hollow section consists of the top flange, bottom flange and the web. The bridge beam has 1500 mm width and 1000 mm height.

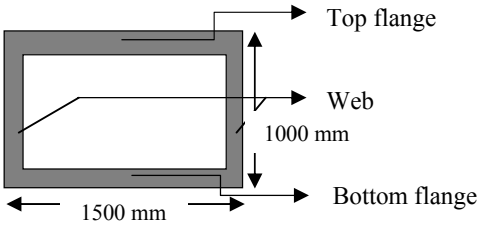


Figure 2. Cross section of bridge beam

The design vehicles nominal axle loads and axle spacing are presented in Figure 3. The impact factor of 1.2 was included in load based on TDTC [9] requirements. The impact factor needs to be considered to cover dynamic load caused by loads movement on the bridge.

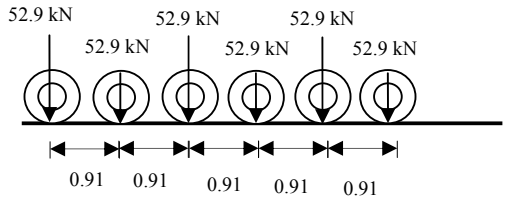


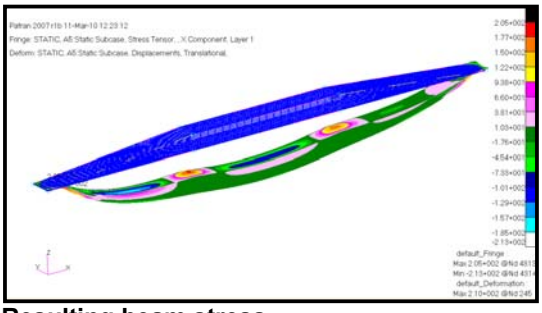
Figure 3. Axle loads and spacing on beam

In order to meet the load requirements, the laminated unidirectional carbon/epoxy beam was made of 48 plies and 24 plies of lamina, for top/bottom flanges and webs of the beam, respectively. The thickness of each lamina is 0.835 mm and arranged in the following sequence and direction: $[90_1/0_{23}]_s$ and $[90_1/0_{11}]_s$ for the flanges and the webs, respectively. Honeycomb, with thickness of 25 mm and 50 mm as the core material is used to reduce the deflection, as the mid span deflection tend to be excessive. The placing of aluminium honeycomb at top flange and web was investigated to ensure that the core is placed at proper location.

Finite Element Analysis

A finite element model of was created and analyzed using MSC NASTRAN. As a result, as may be observed in Figure 4, the structure can support the loads which is subjected to it, where the maximum tensile stress that resulted on the beam is only **205 MPa** which is lesser than tensile strength of the material (**1150 MPa**), given in Table 2, thus giving a very high safety factor for such brittle material

Figure 4. Finite-element analysis result:



Resulting beam stress

Table 2. Carbon Fiber Tow sheet SK N-300 properties

(Source: FOSROC, 2008 & Ronald, 2007*)

Property	Unit	Value
Elastic Modulus 1	MPa	230000
Elastic Modulus 2	MPa	230000
Shear Modulus, G12	MPa	95833
Poisson's Ratio 12		0.2*
Maximum tensile stress	MPa	3450
Allowable tensile stress	MPa	1150
Density	ton/mm^3	1.79641E-09

Comparison to recent research work

The above result is comparable to Robinson and Kosmatka [8], who demonstrate the design and finite-element analysis of treadway system which support MLC30 track and PLS truck vehicles over a 4m gap. In order to meet the weight and bending stiffness requirements, the treadways have upper and lower skins consisting of carbon/epoxy laminates and a celled core composed of E-glass/epoxy webs spaced at 51 mm on center. The core is a fiberglass webbed core which is produced by winding fiberglass roving around individual foam beams which are assembled together with filler fabric between the beams to increase the web thickness.

The carbon/epoxy top and bottom skins were sized as 11 mm and 8 mm thick, respectively, in order to meet the maximum deflection requirements of 152 mm. The skins consist of a 0.61 kg/m2 five harness (5H) satin weave and 0.61 kg/m2 unidirectional carbon. Table 3. gives the summary of the critical lamina stress, allowable strength properties, and margins of safety for each of treadway components.

Table 3. Analyzed margin of safety: maximum stress vs. material strength

Location	Material strength (MPa)	Maximum stress (MPa)	Margin of safety
Top skin	-536	-243	0.48
Bottom skin	883	307	0.92
Webs (shear)	73	43	0.13

Robinson and Kosmatka [8] continued with fabrication of full scale structure. Two treadways (one bridge) were fabricated using the Seemann composite resin infusion molding process (SCRIMP) method, a variant of the vacuum assisted resin transfer molding (VARTM) process. Laboratory proof testing was performed to ensure that the performance requirements were achieved and to validate the finite-element model used in the design. The proof testing showed the treadways to behave linearly without any sign of permanent set or damage. A comparison of the test results and finite-element model showed the model to be a very good representation of the treadway structures. Field testing of the treadways, consisting of 1,600 crossings of fully loaded PLS trucks, showed no decrease in stiffness or damage. The study has shown that the bridge treadways are capable of supporting vehicle loads up to MLC 30 including PLS vehicles and are a viable light-weight versatile bridging solution for use in emergency response and battlefield environments where short-span gaps are encountered.

FUTURE OF CURRENT RESEARCH

Current author's research work is looking to further continue recent development and interest on producing lightweight bridging systems, adopting FRP composite as the innovative element at design and fabrication stage. The research should focus on fabrication of scaled prototype beam and developing experimental testing program. The knowledge gained throughout the research stage should bring several benefits, as Malaysia is currently relying heavily on foreign technology to upgrade its mobile bridging capability for military and civilian uses. The move towards establishing research foundation in this area of expertise is seen to be extremely important and beneficial in the long run.

ACKNOWLEDGMENTS

The writers gratefully acknowledge *Universiti Pertahanan Nasional Malaysia* (UPNM) and Ministry of Science, Technology and Innovation (MOSTI) Malaysia for support and finance provided to this research project.

REFERENCES

[1] Kalpakjian, S., and Schmid, S. R., *Manufacturing Engineering and Technology* (4th Edition). Upper Saddle River, N.J.: Prentice-Hall (2001)

[2] Mazzolani, F. M., "Structural Applications of Aluminium in Civil Engineering", *Structural Engineering International* (2006), 16(4), 280-285

[3] Bakis C.E., Bank L.C., Brown V.L., Cosenza E., Davalos J.F., Lesko J.J., Machida A., Rizkalla S.H., and Triantafillou T.C., "Fiber-Reinforced Polymer Composites for Construction---State-of-the-Art Review", *Journal of Composites for Construction* (2002), 6(2), 73-87

[4] Harries, K., "FRP Bridge Decks—A Maturing Technology", *Journal of Bridge Engineering* (2006), 11(4), 382-382

[5] Tang, B. M., "FRP Composites Technology Brings Advantages to the American Bridge Building Industry", *2nd International*

Workshop on Structural Composites for Infrastructure Applications, Cairo, Egypt (2003)

[6] Wight, R.G., Erki, M.A., Shyu, C.T., Tanovic, R. and Heffernan, P.J., "Development of FRP short-span deployable bridge-experimental results", Journal *of Bridge Engineering* (2006), 11(4), 489-498

[7] Kosmatka, J. B., & Policelli, F. J., "Development of the DARPA/BIR composite army bridge: Phase I accomplishments", *Journal of Advanced Materials* (1999), 31(3), 23-36

[8] Robinson, M. J., & Kosmatka, J. B., "Development of a short-span fiber-reinforced composite bridge for emergency response and military applications." *Journal of Bridge Engineering, (2008), 13*(4), 388-397. ASCE

[9] Hornbeck, B., Connor, R., Kluck, J. (2005), *Trilateral Design and Test Code for Military Bridging and Gap-Crossing Equipment* (2005)

[10] Agusril, Design portable bridge system using composite material. Master Thesis, Universiti Pertahanan Nasional, Kuala Lumpur, Malaysia (2009)

Appling Kalman Filter for Tracked Unmanned Ground Vehicle (UGV) Positioning Tracking

Ahmad Loqman Ahmad Mazuki[1], Kamaruddin Abdul Ghani[2], Nik Ghazali Nik Daud[3], Khairol Amali Ahmad[4]
Jabatan Kejuruteraan Elektrik Elektronik, Universiti Pertahanan National Malaysia
Kem Sungai Besi, 57000, Kuala Lumpur
[1]loqman@upnm.edu.my [2]kamaruddin@upnm.edu.my [3]nikghazali@upnm.edu.my
[4]khairol@upnm.edu.my

Abstract
Positioning tracking of UGV is usually done using sensors of GPS, magnetic compass, inertial and odometer. Kalman filter is usually used to fuse these different sensors measurement to obtain the best positioning estimation. Usually positioning research of outdoor UGV or mobile robot is done using locomotion of wheels and assigning computer or laptop to do the calculation. In this research, track UGV is used. A track kinematics model is used for basic calculation. It uses stepper motor as driver. Sensors of accelerometer and gyroscope are use as inertial measurement. It is fuse together using Kalman filter. The Kalman filter process is done using FPGA board instead of computer or laptop. The research aim to find the optimum distance or time a track UGV can operate with out using GPS or other high cost technique and FPGA application on it. The UGV is intended for outdoor environment, but only on flat surface.

Keywords
Tracked UGV, Kalman filter, FPGA

INTRODUCTION

UGV positioning is a must for any operation. A variety of sensors and techniques has been developed and tested for positioning purpose. In an outdoor environment, the positioning is usually done using Global Positioning System (GPS). It allows reliable accuracy and absolute positioning. With a GPS sensor, the positioning calculation is reduced. To further increase the performance, it has been integrated with Inertial Navigation System (INS) []. However GPS has periodical signal blockage problem at outdoor environment, cannot be used indoor or in closed spaces and has low output rate []. INS/GPS integration of positioning calculation is usually done on a computer or laptop attached to the UGV [].This allow for fast computation process especially for Kalman filter which required heavy matrix multiplication [] at the expanse of power consumption.

Kalman filter required a kinematics model of the UGV that usually use wheels for locomotion. The locomotion of wheeled UGV is easily modeled and used in Kalman filter. Wheels provide a good mobility on hard flat surface in term of speed and power consumption. However on rough terrain, wheels locomotion could not perform as well as tracked UGV.

Therefore in this research, a tracked UGV is used for positioning research. The track is made out of plastic and is shaped like a tank's track. This research uses a dead reckoning method for positioning. Accelerometer and gyroscope sensors are used to measure the movement. These sensors are self-contain and independent of environment and external references [].The UGV is driven by two stepper motors where pulses on each motor are calculated for movement estimation just like the odometer. The pulses provide the basic kinematics position estimation. Kalman filter is used to fuse together the sensors value with the position estimation from kinematics. Furthermore, all the Kalman filter process is done on a Field Programmable Gate Array (FPGA) board. This allows a computer independent system with lower power consumption for processing.

A tracked UGV move similar to a differential drive wheeled UGV, but track movement is different compare to wheels. Track has larger ground contact compares to wheel. It has a continuous track that allows it to overcome holes and climb small obstacle or boulder as well as providing better mobility on rough or soft terrain. However in positioning aspect, it has certain disadvantages, of which the main concern is slippage. Track movement relies on slippage but at the same time it also suffers from lateral slippage. This type of movement contributes to poor dead reckoning information [].In term of kinematics, the motion control methods of differential drive wheeled UGV is not reliable or tracked UGV [].Several author mentioned in [**Error! Bookmark not defined.**] agreed that motion control of tracked UGV is a very complicated problem without an archived general solution.

A dynamic model of tracked UGV is usually complex. Therefore a simpler kinematics model is used. The model is based on kinematics model as in [**Error! Bookmark not defined.**]. Since the

kinematics model alone is not reliable enough, inertial sensors is added in positioning calculation. The Kalman filter is used to fuse the kinematics of tracked UGV estimation with inertial sensors measurement. Several assumptions are made on the calculation for simplification. Some assumption are tracked UGV is expected to move only on flat surface, center of mass is considered to be approximately at the UGV's center, and speed of the tracked UGV is limited to two constant speeds. These simplifications are made so that all the process can be done in approximately real time inside the FPGA board.

Kinematics for Tracked UGV

A tracked UGV is governed by two control input of its left and right track velocity (V_l,V_r). It is a non-holonomic type where two controllable degree of movement produce three degree of freedom. The different velocity of both tracks makes the UGV turn at a certain radius. This turn has a center of rotation that serves as the basic of the kinematics equation.

Instantaneous center of rotation (ICR) is the point on the horizontal plane where rotation occurs with no translation. The ICR of a track is different from ICR of entire vehicle. Therefore it is labeled as ICR_v for the entire vehicle and ICR_l and ICR_r for the left and right tracks. Figure 8 shows the position of each ICR.

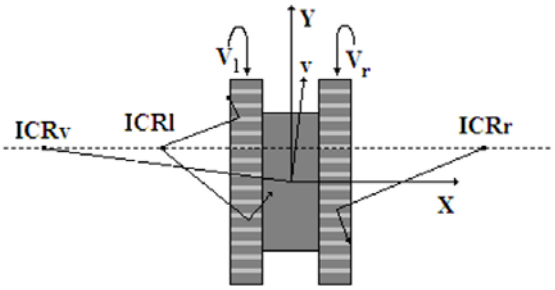


Figure 8. ICRs on the plane

Kinematics equation of tracked UGV can be represented by equation (1) where it is based on [**Error! Bookmark not defined.**]. The equation is with respect to local frame and represents the vehicle's direct kinematics by assuming that ICR right and left could be properly estimated.

$$v_x = \frac{V_r - V_l}{x_{ICRr} - x_{ICRl}} y_{ICRv}$$

$$v_y = \frac{V_r + V_l}{2} - \frac{V_r - V_l}{x_{ICRr} - x_{ICRl}} \left(\frac{x_{ICRr} + x_{ICRl}}{2} \right)$$

$$\omega_z = \frac{V_r - V_l}{x_{ICRr} - x_{ICRl}} \quad (1)$$

It is noted that track ICRs are dynamic-dependent where it always lie outside of track centerline because of slippage. Therefore, track ICRs that are closer to the vehicle has less track slippage. The center of mass also affect track ICRs. Track that is closer to center of mass has closer ICR while the opposite track has further ICR. Less slippage also occur when the center of mass is concentrated more on rear or front of UGV.

Inertial Navigation Sensors

The sensors uses are accelerometer and gyroscope. The accelerometer measures two acceleration axes of 'x' and 'y' while gyroscope it measure one axes 'z'. Both sensors are attached on the UGV approximately at its center of rotation as in Figure 9. Therefore, any measurement from the sensors is with respect to UGV frame. It needs to be translated to the global frame for the final position.

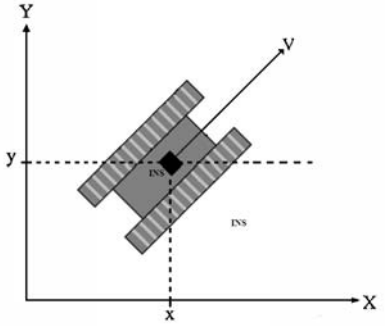


Figure 9. Geometric configuration of INS on UGV

Measurements from sensors need to be integrated to obtain the necessary information. Accelerometer measurements need to be integrated twice to obtain position measurement while gyroscope measurements only need to be integrated once to obtain the rotation degree.

Here both sensors have a drift problem. Both sensors are supposed to have zero output when there is no movement, neglecting the effect of the earth rotation. However some offset, called bias error can be detected. This bias error is a random constant that affect the output of sensors and is the main problem of INS sensors.

When the sensors output are integrated it also includes the bias error. It is even worse for accelerometer output since it is integrated twice. The bias error can only be reset when the UGV stop moving.

Kalman Filter

Combination of measurement data with kinematics estimation is done using Kalman Filter. It is an efficient recursive, estimator using data from incomplete and noisy measurement. Kalman Filter was named after Rudolf Kalman. Kalman filter used the system dynamic model as the control input of the system. Measurement from sensors is used to

calculate the state of the system. It then combines the system input of dynamic model and the sensors measurement of the state the estimate the best state of the system. As such, it is commonly know as sensor fusion.

For electronic navigation, Discrete Kalman filter is used. The equation is divided into two part; Time update equation (2) and Measurement update equation (3) []. The variable x and u is the systems state and control input. Variable A, B and H is the relation matrix. Variable P and K are the error covariance matrix and Kalman gain matrix. Variable Q and R are system and measurement error. Variable I is identity matrix. Variable z is the sensors measurement.

$$\begin{aligned} \hat{x}_k^- &= A\hat{x}_{k-1} + Bu_{k-1} \\ P_k^- &= AP_{k-1}A^T + Q \end{aligned} \tag{2}$$

$$\begin{aligned} K_k &= P_k^- H^T (HP_k^- H^T + R)^{-1} \\ \hat{x}_k &= \hat{x}_k^- + K_k(z_z - H\hat{x}_k^- \\ P_k &= (I - K_k H)P_k^- \end{aligned} \tag{3}$$

Application of Kalman filter required prior knowledge of process and measurement noise. Poor noise estimation will result in poor estimation and divergence of the filter.

Kalman filter requires heavy matrix multiplication and some division. It also had some inversion, as in (3). Therefore, it is usually computed through wireless communication or simply by attaching a laptop on top of the UGV. Calculation of Kalman filter off the computer is done using Field Programmable Gate Array (FPGA) as did by Bona[]. Zhi-Jian[] shows the combination of FPGA board and Digital Signal Processing (DSP) tested using experimental vehicle. Al Dhaher[] shows the use of FPGA to do the matrix by matrix multiplication for Kalman filter and fuzzy logic. It is use to fuse several different measurement.

REFERENCE

[1] A. H. Mohamed, K. P. Schwarz, “Adaptive Kalman Filtering for INS/GPS.” Journal of Geodesy, 1999, vol. 73, pp. 193-203

[2] Hugh H. S. Liu, Grantham K. H., “Accelerometer for Mobile Robot Positioning.” IEEE Transactions On Industry Application. Vol. 37, no. 3, MAY/June 2001.

[3] Vanderlei Bonato, Rafael Peron, Denis F. Wolf, Joao M. P. Cardoso, “An FPGA Implementation for a Kalman Filter with Application to Mobile Robotics.” Industrial Embedded Systems, 2007, SIE’07. International Symposium, pp. 148-155

[4] Dan Simon, “Kalman Filtering”, Embedded System Programming. June 2001

[5] J. Borenstein, H.R. Everett, L. Feng. D. Wehe. “Mobile Robot Positioning-Sensors and Technique.” Journal of Robotic Systems, Special Issue on Mobile Robots. vol. 14 no. 4, pp. 231-249

[6] J. Borenstein, H. R. Everett, L. Feng, “Where am I?” Sensors and Methods for Mobile Robot Positioning,” The University of Michigan, 1996, pp 28-29

[7] J. L. Martinez, A. Mandow, J. Morales, S. Pedraza, A. Garcia-Cerezo, “Approximating Kinematics for Tracked Mobile Robots”, The International Journal of Robotics Research 2005, vol. 24, pp. 867

[8] Greg Welch, Gary Bishop. "An Introduction to the Kalman Filter," Department of Computer Science, University of North Carolina. 2006

[9] BonaV. Bonato, R. Peron, D.F. Wolf, J.A.M. de Holanda, E. Marques, J.M.P. Cardoso, "An FPGA Implementation for a Kalman Filter with Application to Mobile Robot," Industrial Embedded Systems, 2007, SIES'07. International Symposium, pp. 148-155

[10] Zhi-Jian Sun, Xue-Mei Liu, "Application of Floating Point DSP and FPGA in Integration Navigation System," International Conference on Computer Science and Software Engineering, 2008, vol 4, pp. 58-61

[11] A.H.G. Al Dhaher, E.A. Farsi, D. Mackesy, "Data Fusion Architecture-An FPGA Implementation," Proceedings of the IEEE Instrumentation and Measurement Technology Conference, 2005, vol. 3, pp. 1985-1990.

Rainwater Treatment System Using Membrane Filtration for Domestic Use

Yanti S.M.S.[1], Norazman, M.N.[1],. Nordila A.[1], Zuliziana S.[1]
[1]Universiti Pertahanan Nasional Malaysia,
Kem Sg. Besi, 57000 Kuala Lumpur
email : yanti@upnm.edu.my

Abstract
This paper will review the rainwater harvesting system as an alternative water resource in Malaysia. Rainwater harvesting is an age old technique involving capturing or trapping rainwater on roofs or some other surface before it touches the ground and storing it for reuse. Currently in Malaysia, the harvested rainwater is only used as a non-potable usage. Even though there are a lot of rainwater harvesting system has been installed, the rainwater only can be used for non-potable such as watering plant, toilet flushing and general cleaning (car and motorcycle washing). If the rainwater needs to be use for potable such as drinking and bathing, it may require treatment prior depending on anthropogenic like vehicle exhaust and factory fume and natural issues. As such, this study will focus on designing rainwater harvesting system and determination of rainwater treatment system for potable usage.

Keyword
Rainwater Harvesting, Potable use

INTRODUCTION

Malaysia is one of those fortunate nations where renewable water per capita per annum exceeds consumption because of having an abundant amount of rain every year. As an average, Peninsular Malaysia recorded to receive 2400 mm, Sarawak with 3800mm and Sabah with 2600mm annual rainfall. Based on record, it is estimated that Malaysia's citizen use 5300m^3 of water per person per annum, while according to the United Nation's recommendation each citizen should allocated only 1000m^3 of water per annum (Mohamad *et al*., 2005).

Even though this record actually shows Malaysia have an adequate water supply, we cannot ensure that Malaysia will not be facing the natural disaster like drought. Crisis in April 1998 which brought unpleasant water supply disruption for 1.8 million residents in the Klang and Langat Valley indicated that Malaysia need to find alternative water resources (Pioa, 2007). Other than that, the alternative water resource will be the right solution in meeting water demand resulting from population growth, urbanization and industrialization.

Background of Study

Rainwater Harvesting has been practiced all over the world for over 4000 years. The ancient Romans would use the courtyards of their villas to capture water to be stored in large underground cisterns. In Malaysia, rainwater harvesting has been introduced decades ago which in rural areas, the large open jar called "tempayan" has been used for watering the plant and cleaning purposes. Nowadays, domestic rainwater harvesting systems are common in many parts of East Africa, Central Australia, Southeast Asia, Mexico and Central America, and numerous Caribbean Island. In Hong Kong, the skyscrapers collect rainwater for the requirements of the premise while in cities that are prone to earthquakes, this captured rainwater functions as a back-up system for fire-fighting purposes (Appan, 1999).

In the effort to seek the alternative water resources, the Ministry of Housing and Local Government had expressed the Malaysian government interest for houses to be designed to be collecting rainwater. The Ministry has produced a Guideline on Installing a Rainwater Collection and Utilization System as a reference in order to encourage people to harvest the rainwater. Introduces after the 1998 drought, it aims at reducing the dependence on treated water and provides a convenient buffer in times of emergency or a shortfall in the water supply other than act as urban flood control.

Rainwater harvesting system is a process which collecting the rainwater from the rooftop catchment's, open surface and also pavement or gravel surface (catchment's system) to the storage tank (storage system) via gutter and down pipes (conveyance's system) for later use.

A division of the Ministry of Agriculture, National Hydraulic Research Institute of Malaysia (NAHRIM), Department of Irrigation and Drainage (DID) and local university are currently pursuing research and development on rainwater harvesting focusing on hydrologic and hydraulic design, system design and performance, installation and operational costs and water quality aspects.(Ahmad and Huang, 2007). Figure 1 shows the simple rainwater harvesting system.

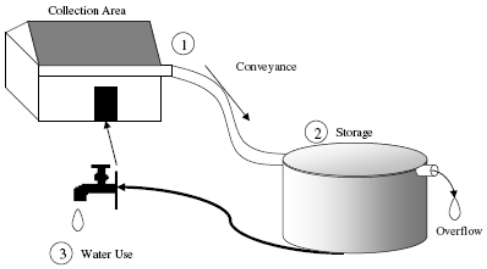


Figure 1: Simple Rainwater Harvesting System

Objectives

The objectives of this paper are:

i. To design and evaluate the potential of rainwater harvesting system in providing the rainfall as potable usage and
ii. To determine the quality of harvested rainwater whether it can be use for drinking purposed or not.

Scope of Work

i. The catchment's area of the study is double storey house located in Sungai Besi Military Camp
ii. Determination of rainfall data (intensity of rainwater)
iii. Designing the rainwater harvesting system
iv. Determination of rainwater quality, which will be test in laboratory
v. Determination of rainwater treatment system

Importance of Study

This study is important as we need a sustainable water management in future. Rainwater harvesting system was very helpful in reducing some environmental problems such as soil erosion and mitigated urban flooding other than become an alternative water resource especially during drought.

This study will conducts a new idea of designing rainwater harvesting system which it can give an aesthetic value for housing area as our government is in effort to compel every single house in our country to harvest the rainwater. This design also will overcome the problem of not having enough space to locate the bulky and large rainwater storage tank in their house.

LITERATURE REVIEW

Rainwater Harvesting System in Malaysia

National Hydraulic Research Institute of Malaysia (NAHRIM) has been accountable to carried out three main pilot projects for rainwater harvesting. The three main pilot projects are:

i. A double storey terrace house located at Taman Wangsa Melawati, Kuala Lumpur.
ii. A mosque complex at Taman Bukit Indah, Ampang.
iii. The Headquarters of the Department of Irrigation and Drainage (DID), Kuala Lumpur.

These three pilot projects have used different kind of rainwater harvesting system. For project double-storey house, they have used the rooftop (cement tiles) to catch the rainwater. While, for mosque complex they have used underground catchment system. The tank to store rainwater located below the mosque car park.

Class of Water

In this research, we are trying to provide the higher quality of harvested rainwater which it can be use for potable usage such as bathing, cooking and drinking. Table 1 shows the water classes.

Table 1: Water Classes

Classes	Uses
Class I	Conservation of natural environment water supply 1-prctically and treatment necessary (fishery 1- very sensitive aquatic species)
Class IIA	Water supply 2- conventional treatment required (fishery 2- sensitive aquatic species)
Class IIB	Recreational use with body contact
Class III	Water supply 3- extensive treatment required (fishery 3- common of economic value and tolerant species livestock drinking)
Class 1V	Irrigation
Class V	None of the above

Source adapted from Water Quality Index (WQI)

Rainwater Treatment System

As rainwater may be contaminated, it is often not considered suitable for drinking without treatment. This study also will be focused on the selection of an appropriate method to treat the rainwater for domestic usage. The methods must be reliable, practical and cost-effective. Table 2 shows some of the methods to treat the rainwater.

Table 2: Water treatment method

Method	Description
Activated Carbon System	• Effective in removing chemicals, microorganisms, taste and odors from water (even chlorine) • Cannot remove heavy metals and dissolved solids
Micro porous Basic Filtration	• Categorized as depth, screen or surface filtration system • Contaminant larger than interstitial spaces will retained
Ultra filtration (UF)	• Molecular sieve • Permeable membrane which retains most macromolecules above a sieve size
Ultraviolet Radiation (UV)	• Use special lamps that generate light of specific wavelengths that result in the inactivation of certain

	microorganisms

Source from Emmanuel U.N *et al.*, 2010

METHODOLOGY

The methodology will focus on designing rainwater harvesting system and rainwater treatment method which can improve the quality of harvested rainwater. The design will consider some factors such as water demand and rainfall intensity. The design procedure of this study is summarised in Figure 2 whilst the layout plan of rainwater harvesting system is presented in Figure 3.

EXPECTED RESULT

The expected result is producing the new design for rainwater harvesting system with having the esthetic value in terms of the arrangement and the shape of water tank and providing the harvested rainwater with water quality in Class 1.

CONCLUSION

Based on the previous research, it can be concluded that the rainwater harvesting system can be very helpful in providing the alternative water resource especially during drought and suitable for region that have been facing the scarcity of water supply.

ACKNOWLEDGEMENT

The authors wish to thank the supervisors and technical team for giving advices and guidance to do this project. This study is supported by FRGS, administered by the Research Management Centre, UPNM.

REFERENCES

[1] Ahmad, J. S and Huang, Y.F, (2007). Nahrim's Experience in Rainwater Utilisation System Research. Proceedings of Colloquium on Rainwater Utilisation 2007, NAHRIM, 19-20 April 2007, Dewan Baiduri, Wisma Sumber Asli, NRE, Putrajaya, Malaysia.

[2] Mohamad Afifi, Fatimah Mohd. Noor, Pheng, T. S., (2005). Rainwater Harvesting- An Opportunity Neglected. Water Malaysia Issue, August 2005, Universiti Teknologi Malaysia, Johor.

[3] Pioa, L. K., (2007). Rainwater Harvesting Storage System Analysis. B Eng (Hons.) Thesis, Universiti Teknologi Malaysia, Johor.

[4] Appan, A., (1999). Economic and Water Quality Aspect of Rainwater Catchment System. Proceedings of International Symposium on Efficient Water Use in Urban Areas, UNEP Int.Environ. Tech. Center, Osaka, Japan, 79pp.

[5] Emmanuel,U. N., Srujana, S., Eun, J. L., (2010). Analysis and Treatment of Harvested Rainwater. World Environmental and Water Resources Congress 2010, 16-20 May, Providence, Rhode Island, 501-502.

Biosorption of Heavy Metal Ions from Aqueous Solutions by Bamboo Sawdust

Nor Syahidah Ghani[1], O.Sulaiman[1,*], M. Rafatullah[1], R. Hashim[1] and A. Ahmad[2]

[1]Bioresource, Paper and Coatings Technology Division, School of Industrial Technology, Universiti Sains Malaysia, 11800 Minden, Penang, Malaysia

[2]Environmental Technology Division, School of Industrial Technology, Universiti Sains Malaysia, 11800 Minden, Penang, Malaysia

*osulaiman@gmail.com

Abstract

Bamboo sawdust is an agricultural resources and economical material has been used as a biosorbent for removal of zinc (II) ions from aqueous solutions. Langmuir and Freundlich biosorption isotherm model were applied to analyze the maximum capacity biosorption of zinc (II) ions onto bamboo sawdust at different concentration and temperature. The Langmuir biosorption isotherm model was found fitted well with maximum monolayer sorption capacity is 107.52 mg/g. Comparison of this work to the other previous researches was indicated bamboo sawdust can be used as alternative and environmentally friendly biosorbent for removal of zinc (II) ions from aqueous solutions.

Keywords

Bamboo sawdust, Biosorption, Zinc (II) ions, Isotherm.

INTRODUCTION

Heavy metal pollution has become heated issues for the most country due to rapidly growth of industrial sector nowadays. Zinc which mostly in found electroplating brass and bronze production and galvanization piping was listed one of the 13th important toxic metals in United State Environmental Protection Agency (USEPA) (Cesur et al., 2007). Excessive exposure of zinc ion was caused muscular stiffness, depression, lethargy and nausea to the health human due to toxicity and non biodegradable of zinc ions (Lesmana et al.,2009, Kurniawan et al,2006). The permissible limit of zinc ion discharged into water has been fixed is 5mg/L by Environmental Protection Agency (EPA) (Deliyanni et al., 2007). Therefore, elimination of heavy metal ions from wastewater is indispensable.

Ultrafiltration, ion exchange, chemical precipitation and reverse osmosis are the common treatment used for removal heavy metal ions from wastewater (Weng et al., 2004, Kobya et al., 2005). However inefficiency and limitation cost for small industries was lead biosorption most frequently applied for the treatment heavy metal ion from wastewater pollution due to simple process, effectiveness, economical and variety of biosorbent. Recently, usage of agricultural and by-products waste as an alternative biosorbent for removal heavy metal ions has attracted the attention of researchers and scientist to use it due to costly of activated carbon. Renewable, abundantly in nature, cheap, effectiveness and unique chemical composition of agricultural and by-products waste has chosen as suitable alternative biosorbent for removal heavy metal. Some of researchers have reported banana leaves (Nada et al., 2010), orange waste (Pérez-Marín et al., 2008), meranti sawdust (Rafatullah et al., 2009), almond green hull (Ahmadpour et al., 2009) and rice husk ash (Naiya et al., 2009) was used as an biosorbent for removal heavy metal ion from wastewater.

Sawdust which is one of the by product waste is cheaper, abundantly and widely available in nature has been created attention to be used as a biosorbent. Bamboo is one of renewable and abundantly resources in Malaysia are chosen as an alternative biosorbent for removal zinc (II) ion from aqueous solution. The main aim of this research is to assess the potential of bamboo sawdust as a biosorbent for removal of zinc (II) ions from aqueous solutions. The biosorption isotherm studies was calculated and discussed.

MATERIAL AND METHODOLGY

Preparation of biosorbent

Semantan bamboo (*Gigantochloa scortechinii*) which collected from Nami, Kedah, Peninsular Malaysia was used as a biosorbent for removal zinc (II) ions from aqueous solution. Bamboo was cut into small sizes, washed and dried overnight at 50^{o}C. The bamboo was grounded to produce sawdust by a grinder machine. Then, the bamboo sawdust was treated with 0.5M Hydrochloric acid solution at room temperature for 4 hour to remove colour and water-soluble substances and filter out, rinsed with distilled water and dried in oven at 70^{o}C overnight. Further, the bamboo sawdust was sieved by sieve machine.

Preparation of adsorbate solution

Adsorbate solution of zinc (II) ions was prepared by diluting Zinc (II) nitrate hexahydrate (Sigma-aldrich. $Zn(NO_3)_2 \cdot 6H_2O$) in distilled water. Stock solution was further diluted to the required concentrations.

Isothermic studies

Isothermic studies were carried out by shaking 0.5g of bamboo sawdust with 50ml of the zinc (II) aqueous solution at different concentration (10 to 60ppm) at different temperature (30, 40, 50^{o}C) for 120 minutes using a temperature controlled shaker. The mixtures were agitated at 125 rpm. After reaction, the mixtures were filtered out and analyzed using an Atomic Absorption Spectrometer, AAS (Analyst 100 Perkin Elmer) for its metal ions concentrations. All of the experiments were perform in triplicate to ensure the data reliability. Langmuir and Freundlich biosorption model were applied to quantify the biodsorption capacity of zinc (II) ions onto bamboo sawdust.

RESULT AND DISCUSSION

Biosorption isotherm studies

The biosorption isotherm elucidated the specific relationship between distribution of biosorption molecules with the liquid and solid phase at a constant temperature when the biosorption process reaches at equilibrium state. The biosorption equilibrium data of zinc (II) ions on bamboo sawdust was analyzed in term Langmuir and Freundlich isotherm models to quantify the biosorption capacity.

Langmuir isotherm models

Langmuir (1918) was depicted monolayer adsorption occur onto a specific surface homogenous sites of adsorbent. The data of the equilibrium studies for adsorption of zinc (II) ions onto bamboo sawdust is following the equation:

$$Ce/A_m = (1/k)\,(1/b) + (1/b)\,Ce \qquad (1)$$

Where Ce is the equilibrium concentration of zinc (II) ions solution (mg/L), A_m is the amount adsorbed per specified amount of adsorbent (mg/g), k is the equilibrium constant and *b* is the amount of adsorbate required to form monolayer. When a graph Ce/A_m is plotted against Ce, a straight line with a slope ($1/K_L$) and an intercept ($1/bK_L$) are obtained as showed in Figure 1. The correlation coefficient (R^2) value was used to judge the applicability of the biosorption isotherm. The correlation coefficient (R^2) values of 0.993 to 0.998 were indicated the biosorption equilibrium data of zinc (II) ions onto bamboo sawdust was well fitted to the Langmuir isotherm models. The values of constants k and b were calculated from the Figure 1 and tabulated in Table 1.

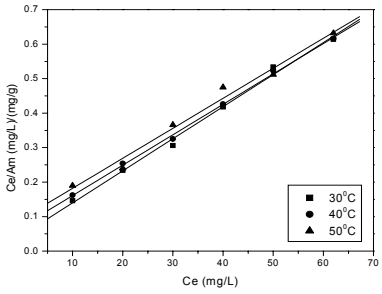


Figure 1. Langmuir isotherm model of bamboo sawdust

Freundlich isotherm models

According to Freundich isotherm models, it assumes the adsorption occurs on a heterogenous adsorbent surface and can be applied for multilayer sorption (Freundlich, 1907). The Freundlich isotherm is expressed as:

$$A_m = (K)(Ce)^{1/n} \qquad (2)$$

$$\ln A_m = \ln K + (1/n) \ln Ce \qquad (3)$$

Where n is an empirical constant and all the rest of the terms are same as before. A straight line is obtained with a slope 1/n and an intercept of ln K when ln A_m is plotted versus ln Ce as presented in Figure 2. The all related parameters were calculated and reported in Table 1.

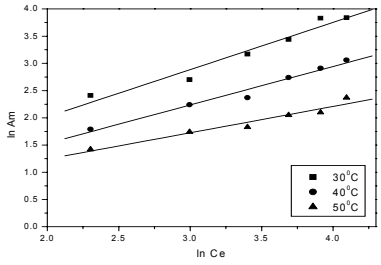


Figure 2 Freundlich isotherm model of bamboo sawdust

As can been observed from Table 1, Langmuir biosorption isotherm models has showed the highest R^2 values at all temperatures compared to the Freundlich biosorption isotherm models and further conveyed the Langmuir biosorption isotherm model is yielded the best fit. Table 2 is presented the lists of a comparison of maximum monolayer biosorption capacity of zinc (II) ions on various adsorbent. From the Table 2, the bamboo sawdust was found to have a relatively large adsorption capacity of 107.52 mg/g and indicates it could be considered as promising material for removal of zinc (II) ions from aqueous solution.

Table 1. Biosorption of isotherm constants and correlation coefficients for the biosorption of zinc (II) ions on bamboo sawdust at different temperatures

Biosorption isotherms and its constants	Temperatures (°C)		
	30	40	50
Langmuir biosorption isotherm constants			
b (mg/g)	107.52	113.63	114.94
K_L (L/mg)	0.199	0.121	0.091
R^2	0.993	0.998	0.983
Freundlich biosorption isotherm constants			
K_F (mg/g)(L/mg)$^{1/n}$	1.325	1.121	1.312
n	1.152	1.1414	2.064
R^2	0.954	0.974	0.950

Table 2. Comparison of maximum biosorption capacities of different biosorbents for Zinc (II) ions

Biosorbents	Maximum monolayer sorption capacity (mg/g)	References
Bamboo sawdust	107.52	This study
Palm tree leaves	14.6	Fahmi (2006)
Erythrina variegate orientalis leaf powder	17.24	Venkateswarlu et al., (2008)
Moringa Oleifera Lam. (horseradish tree) biomass	40.99	Bhatti et al., (2007)
Peanut hulls pellet	10.00	Brown et al., (2000)
Cassava waste	11.06	Abia et al., (2003)
Sawdust	10.96	Shukla et al., (2005)
Olive oil mill residue	5.63	Hawari et al., (2009)

CONCLUSION

The present work highlighted that bamboo sawdust which an economical agricultural waste biomass can be promising biosorbent for removal zinc (II) ions from aqueous solution. The Langmuir biosorption isotherm model was showed equilibrium data fitted very well compared with the Freundlich biosorption model. The monolayer sorption capacity of zinc (II) ions onto bamboo sawdust was obtained 107.52 mg/g at 30°C. Low cost and effectiveness of bamboo sawdust would offer as an alternative biosorbent for removal zinc (II) ions from wastewater treatment process.

ACKNOWLEDGEMENT

The authors acknowledged the Universiti Sains Malaysia for providing the Fundamental Research Grant Scheme, Fellowship Scheme for Nor Syahidah Ghani and Posdoctoral Fellowship Scheme for Dr. M. Rafatullah. The authors also acknowledged Institute of Postgraduate Studies (IPS), Universiti Sains Malaysia for supporting Nur Syahidah to attend this conference.

REFERENCE

[1] C. Cesur, N. Balkaya. Zinc removal from aqueous solution using an industrial by-product phosphogypsum. *Chem Eng J*., 13 (2007) 203-208.

[2] S. O. Lesmana, N. Febriana, F.E. Soetaredjo, J. Sunarso, S. Ismadji. Review studies on potential applications of biomass for the separation of heavy metals from water and wastewater. *Biochemical Engineering Journal*., 44 (2009) 19-41.

[3] T. A. Kurniawan, G. Y. S. Chan,W. Lo, S. Babe. Review comparisons of low-cost adsorbents for treating wastewaters laden with heavy metals. *Science of the Total Environment*., 36 (2006) 409-426.

[4] E. A. Deliyanni, E. N. Peleka, K. A. Matis K.A. Removal of zinc ion from water by sorption onto iron-based nanoadsorbent. *Journal of Hazardous Material.,* 141 (2007) 176-184.

[5] C-H. Weng C. P. Huang. Adsorption characteristics of Zn (II) from dilute aqueous solution by fly ash. *Colloids and Surfaces A: Physiochem. Eng. Aspects*., 247 (2004) 137-143.

[6] M. Kobya, E. Demirbas, E. Senturk, M. Ince. Adsorption of heavy metal ions from aqueous solutions by activated carbon prepared from apricot stone. *Bioresources Technology.,* 96 (2005) 1518-1521.

[7] A. M. A. Nada, A. A. El-Gendy, S. H. Mohamed. Banana leaves as adsorbents for removal of metal ions from wastewater. *Carbohydrates Polymers*., 2010.

[8] A. B. Pérez-Marín, A. Ballester, F. González, M. Blázquez, J. A. Muñoz, J. Sáez, V. M. Zapata. Study of cadmium, zinc and lead biosorptiom by orange wastes using the subsequent addition method. *Bioresource Technology*., 99 (2008) 8108-8106.

[9] M. Rafatullah, O. Sulaiman, R. Hashim, A. Ahmad. Adsorption of copper (II), chromium (III), nickel (II) and lead (II) ions from aqueous solution by meranti sawdust. *Journal of Hazardous Materials.,* 170 (2009) 969-977.

[10] A. Ahmadpour, M. Tahmasbi, T. R. Bastami, J. A. Besharati. Rapid removal of cobalt ion from aqueous solutions by almond green hull. *Journal of Hazardous Materials.,* 166 (2009) 925-930.

[11] T. K. Naiya, A. K. Bhattacharya, S. Mandal, S. K. Das. The adsorption of lead (II) ions on rice husk ash. *Journal of Hazardous Materials*., 163 (2009) 1254-1264.

[12] I. Langmuir. The adsorption of gases on plane surface of glass, mica and platinum. *Journal American Chemistry Sociecty*., 40 (1918) 1361-1403.

[13] H. Freudlinch. Ueber die adsorption in Loesungen. *Z Physic Chemistry*., 57 (1907) 385- 470.

[14] A-R. A. Fahmi. Biosorption of Zinc on palm tree leaves: Equilibrium, kinetics and thermodynamic studies. *Separation Science and Technology*., 41 (2006) 3499-3515.

[15] P. Venkateswarlu, G. V. Durga, N. C. Babu, M. V. Roa. Biosorption of Zn(II) from an aqueous solution by *Erythrina variegate* orientalis leaf powder. *International Journal of Physical Sciences*., 3 (2008) 197-204.

[16] H. N. Bhatti, B. Mumtaz, M. A. Hanif, R. Nadeem. Removal of Zn (II) ions from aqueous solution using *Moringa oleifera* Lam. (horseradish tree) biomass. *Process Biochemistry*., 42 (2007) 547-553.

Effect of Sucrose Addition on the Mechanical and Physical Properties of Binderless Particleboard Made from Oil Palm Trunk

Junidah Lamaming[1], Tomoko Sugimoto[2], Othman Sulaiman[1] , Rokiah Hashim[1*], Masatoshi Sato[3] , Ryohei Tanaka[4]
[1]Division of Bio-resource, Paper and Coatings Technology, School of Industrial Technology, Universiti Sains Malaysia, 11800 Minden, Penang, Malaysia
[2]Japan International Research Center for Agricultural Sciences, 1-1, Owashi, Tsukuba, Ibaraki 305-8686, Japan
[3]Graduate School of Agricultural and Life Sciences, The University of Tokyo, 1-1-1, Yayoi, Bunkyo-ku, Tokyo, 113-8657, Japan
[4]Forestry and Forest Products Research Institute (FFPRI), Tsukuba,Ibaraki 305-8687, Japan
E-mail address: hrokiah@usm.my (R. Hashim)

Abstract
The effect of sucrose addition on the mechanical and physical properties of binderless particleboard made from oil palm trunk (OPT) was evaluated to investigate its influence on self bonding of such boards. Four types of binderless particleboards were made from; 1) OPT particles that was extracted with hot water, 2) OPT particles that was extracted with hot water then with addition of sucrose 3) OPT particles without extraction 4) OPT particles without extraction and with addition of sucrose. Initial moisture content of the particle was around 6%-8%. Addition of sucrose to the extracted board improved the MOR and IB value to from 3.92 MPa and 0.17 MPa to 10.21 MPa and 0.79 MPa respectively. Water absorption (WA) and thickness swelling (TS) values also tend to decrease to 136 % from 211.03 and 111.06 % to 51.29 %. Therefore, it was suggested that the self bonding of binderless board was influenced by the free sugar exists in the oil palm trunk.

Keywords
Binderless board; Self-bonding; Oil palm trunk; sucrose

INTRODUCTION

Development on binderless board has been arisen recently. This is in line with the world campaign to produce environmentally products and to achieve the long-term zero waste. Binderless boards seem to have a better future in the industry as the world-wide demand for wood-based panels has been increasing. Binderless board could be a choice for effective utilization of biomass waste in developing countries where the wood resources and chemical is limited [1].

Oil palm (*Elaeis guineesis*) is one of the most important commercial crops in Malaysia. Left to be burned during replanting activities, unutilized oil palm trunk is generated in great abundance at the plantation. These vast availability resources give promising potential uses for the value added products such as wood based panels.

Clarification and evaluation of the self-bonding mechanism is necessary to improve the performance and application of binderless boards [2]. Activation of chemical components of the boards constituents has been shown to contribute self bonding [3-4].It is also possible that sugars exist in the lignocellulosics materials contributed to the self- bonding mechanism. Patents filed by Stofko and Shen indicated that bonding of the particles was accomplished by the existence of free sugar, carbohydrates, or saccharides that act as bonding and bulking agent pressed at a temperature of 180 ˚C [5-6].They also added that during the hot moulding treatment, residual sugars, sugars polymers, furfural products and other decomposition products will crosslink and thermoset. Sucrose is a main sugar exists in oil palm trunk [7-8]. It is a disaccharide that can be made from the combination of the two monosaccharide, glucose and fructose. From previous studies, one of the major factors for having acceptable mechanical properties of the panels is due to the viscoelectric nature of oil palm particle from trunk which is rich in carbohydrate content. In addition, the strength properties of the samples also could be enhanced by possible chemical interaction between particles due to the carbohydrate content by means of temperature and pressure during pressing of the mats [9].

In this study, we focus on the effect of addition of sucrose additives on the mechanical properties of binderless particleboard made from oil palm trunk in order to assess the self-bonding mechanism through the evaluation on the mechanical and physical analyses.

MATERIALS AND METHODS

The oil palm trunk, obtained from a plantation was cut, chipped and air dried. The chips were grounded process to fine particles within range of 0 to 1000µm before screening process is conducted. The moisture content of the particles was about 6% - 8%.

Four types of boards, control board, extracted board by water extraction, board with extractives (extractives from water extraction) and extracted board by water extraction with additional of additives were prepared. All boards were fabricated by hot pressing at 180°C for 20 min with 0.5 MPa pressure at a target density of 0.8 g/cm^3.The weighed particles were hand-formed into homogenous and evenly single-layered mats using a forming box. Then, the formed mats were pre pressed manually before hot press machine under certain condition mention before. Six replicates were made for each type of board.

The oil palm trunk particles were extracted with hot distilled water at 60 °C ± 3 °C thermostat controlled for 6 hour and then filtered using a Buchner funnel. The residue then dried and the moisture content was 6% -8% respectively. The filtered extractives was stored at a freezer before undergo next step.

The mechanical and physical properties of all boards including modulus of rupture (MOR), Modulus of Elasticity (MOE), internal bond strength (IB), thickness swelling (TS), and water absorption (WA) were carried out according to JIS A 5908-2003 (Particleboards) [10]. Bending test was conducted at a concentrated load at the rate of 10mm/min. The specimen size for bending tests was 50 × 200mm with effective span of 150mm. The sample size for the IB, TS, and WA tests was 50 × 50mm. Water absorption (WA) testing was done for 24 hours.

RESULTS AND DISCUSSION

Internal bond strength (IB)

Internal bond values are presented in Figure 1. All the board tested passes the JIS A 5908:2003 Type 8 for particle board. Assuming that the extractives play a certain role in bonding, we extract out the extractives and made a board. As expected, the extracted board shows the lowest IB value. Extraction by hot water makes the particles extractives free and removing almost all of the water soluble materials especially sugar. Due to this removal of extractives like sugar, carbohydrates and starch, the particles become more light and porous.

Boards with sucrose added to both control and extraction board showed the IB value increasing. Shen and Stofko claimed that sugar and water soluble materials will polymerize and bond in situ, thus transformed and thermoset to a cross linked rigid substance [5-6]. It has been supported that degradation of chemical components occurs during hot pressing [2-4]. This was proved when the control board added with sucrose tends to give the highest IB value which is 1.91 MPa.

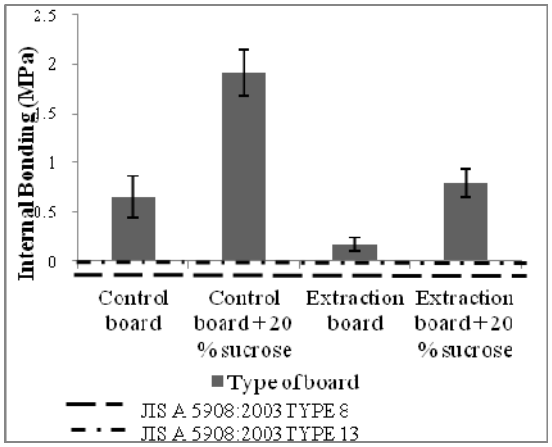


Figure 1 Average value of internal bonding for different type of boards

Modulus of Rupture (MOR)

The MOR quantifies the ultimate bending strength of material. As no resin or adhesives being used in making binderless board, the testing results were not expected to give any extreme qualities in bending strength.

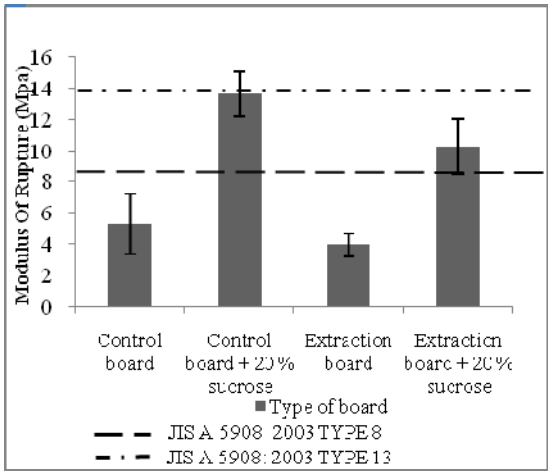


Figure 10 Average value of modulus of rupture for different type of boards

Figure 2 showed the MOR values for all the boards tested. The control with the additional of sucrose gives high MOR value which 13.59 MPa but the MOR values decreased if the sucrose was added to the control board. MOR values of control board and extraction board is 5.25 MPa and 3.92 MPa whilst

the sucrose added to extraction board gives 10.21 MPa. Removal of some extractives during the hot extraction probably facilitate made the sugar to depolymerize and thermoset in situ easily.

Thickness Swelling and Water Absorption

The WA and TS values after 24 h in water are illustrated in Figure 3, respectively. Extraction board shows high water absorption as well as thickness swelling compared to other boards. When the extraction boards were added by the sucrose, WA and TS values tend to decrease to 136% from 211 and 111% to 51%.This means that the sugar also contributing in holding the fibers from swelling too much. The total thickness swelling of boards after immersion in water is attributed to the release of the compressive stresses, hygroscopic swelling of the fibers, and the deterioration of the inter-particle bonding [11]. The higher the swelling, the greater the strength loss.

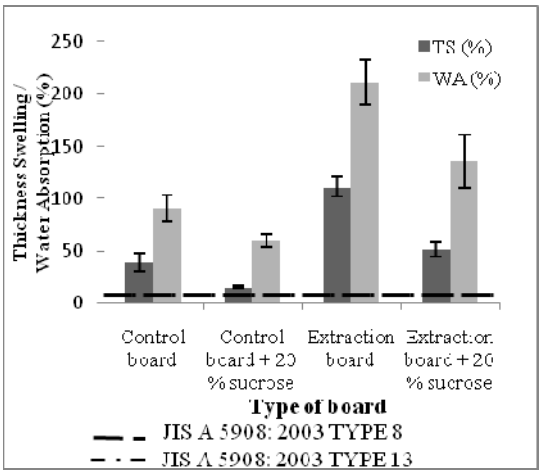


Figure 3: Average values of thickness swelling and water absorption for different type of boards

CONCLUSIONS

The extraction boards showed high result in MOR and internal bonding strength which could be due to the removal of some extractives during the hot extraction and made the sugar depolymerized and thermoset in situ easily. Thickness swelling and water absorption values also give better results when sucrose is added onto the board. This suggested that, the presence of sugar also give effect in contributing to the self bonding mechanism. Further research is still in progress to evaluate the influence of other types of free sugars on the self bonding properties of binderless boards.

ACKNOWLEDGEMENTS

The authors would like to acknowledge JIRCAS for partly supported the project and Universiti Sains Malaysia (USM) for the Fellowship of Junidah Lamaming. We are also truly thankful to Institute of Post Graduate Studies, USM for funding to attend this conference. Our appreciation also goes to KLK, Kepong, Malaysia, Northern Branch for the oil palm samples.

REFERENCES

[1] Mobarak. F, F.Y., Augustin.H,, *Binderless lignocelluloses composites from bagasse and mechanism of self bonding.* Holzforshung, 1982. 36: p. 131-135.

[2] Okuda, N., K. Hori, and M. Sato, *Chemical changes of kenaf core binderless boards during hot pressing (II): effects on the binderless board properties.* Journal of Wood Science, 2006. **52**(3): p. 249-254.

[3] Widyorini, R., et al., *Self-bonding characteristics of binderless kenaf core composites.* Wood Science and Technology, 2005. **39**(8): p. 651-662.

[4] Okuda, N., K. Hori, and M. Sato, *Chemical changes of kenaf core binderless boards during hot pressing (I): influence of the pressing temperature condition.* Journal of Wood Science, 2006. **52**(3): p. 244-248.

[5] Stofko, J., *Bonding of solid lignocellulosic material*. 1980, John Jansky (Paris,France): United States.

[6] Shen, K.C., *Process for manufacturing composite products from lignocellulosic materials*. 1986, K. C. Shen Technology International Ltd. (Ottawa, CA): United States.

[7] Tomimura, Y., *Chemical Characteristic and Utilisation of Oil Palm Trunks.* JARQ, 1992. **25**(4): p. 283-288.

[8] Yamada, H., et al., *Old oil palm trunk: A promising source of sugars for bioethanol production.* Biomass and Bioenergy, 2010. **34**(11): p. 1608-1613.

[9] Hashim, R., et al., *Effect of particle geometry on the properties of binderless particleboard manufactured from oil palm trunk.* Materials & Design, 2010. **31**(9): p. 4251-4257.

[10] JIS-A 5908, *Particleboards.* 2003, Japanese Standard Association, 1-24 Akasaka,4 Minato-ku, Japan.

[11] Onwona-Agyeman S, T.M., Shigematsu M, Kyomori K, Nomura M *Sawdust Boards Fabricated by the High-Pressure Steam Process*. Research on the Environment of the Earth, 2002. **52**: p. 167-177

Determination of Optimum Condition for Alkaline Subcritical Water Extraction of 2-Pyrone 4, 6-Dicarboxylic Acid Precursors from Oil Palm Biomass by High Performance Liquid Chromatography

Nur Syahirah Saary [1], Fumio Kawamura [2], Rokiah Hashim [1,*], Othman Sulaiman [1], Koh Hashida [2], Yuichiro Otsuka [2], Masaya Nakamura [3] and Seiji Ohara [4].

[1] Division of Bio-resource, Paper and Coatings Technology, School of Industrial Technology, Universiti Sains Malaysia (USM), 11800 Minden, Penang, Malaysia

[2] Department of Biomass Chemistry, Forestry and Forest Products Research Institute (FFPRI), Tsukuba, Ibaraki 305-8687, Japan

[3] Department of Applied Microbiology, FFPRI, Tsukuba, Ibaraki 305-8687, Japan

[4] Principal Research Coordinator, FFPRI, Tsukuba, Ibaraki 305-8687, Japan

*Corresponding author:

E-mail address: hrokiah@usm.my (Rokiah Hashim)

ABSTRACT

A high-performance liquid chromatographic (HPLC) separation method with UV/VIS detection has been used for the determination of optimum condition of 2-pyrone-4,6-dicarboxylic acid (PDC) precursors. The chromatographic analysis of PDC precursors was carried out after alkaline treatment. The gradient program of HPLC was well optimized with fourteen kinds of PDC precursor standards. Results indicated that 1.0M NaOH, 180^{0}C, 20 min and 100ml solution is the best condition for alkaline treatment of oil palm biomass. The results suggest that this kind of extraction possibly has great potential as a method for preparation of 2-pyrone determine 2-pyrone 4,6-dicarboxylic acid precursors.

Keywords

Oil palm; Phenolic compounds; 2-pyrone-4,6-dicarboxylic acid; HPLC; Alkaline treatment.

INTRODUCTION

Oil palm (*Elaeis guineensis)*, was originally planted in West Africa has been used from ancient times as a source of edible oil [7]. This monocotyledonous plant of the palm family (*Arecaceae*) can be recognized on the basis of their fruit characteristics. Currently, most of the world's production of palm oil comes from South-East Asia, in particular Malaysia and Indonesia. In year 2006, the palm oil production in Malaysia increased to 16.5 million metric tons. Palm oil industry in Malaysia also produces huge quantity of oil palm biomass including oil palm trunks, oil palm fronds, empty fruit bunches (EFB), kernel, shell and fibres [3]. Oil palm biomass varied in term of its morphology, it would therefore necessary to deal with many compounds in an attempt to convert biomass to useful products [5]. Oil palm solid waste can be considered as a sustainable and also renewable lignocellulosic material [3]. These residues generated during oil palm extraction process could be used as raw for cellulose, lignin and hemicelluloses production [1].

Precursor for making 2-pyrone-4, 6-dicarbocylic acid (PDC) is synthesized from phenolic compound in lignin monomers. 2-pyrone-4,6-dicarbocylic acid. (PDC) is a substance with a structure containing a pyran ring with two carboxylic acid groups. PDC has two carboxylic acid groups and the conversion of these groups into derivatives would make it a potential raw material for various novels, bio-based polymers [11]. Lignin is generally distributed as a matrix component with hemicelluloses in the spaces of intercellulose microfibrils in primary and secondary walls and in middle lamellae [6]. Phenolic hydroxyl, benzylic hydroxyl, and carbonyl groups are the functional groups of major influence upon the reactivity of lignin. Their presence might be in accordance to the morphological location of the lignins [13].

Michinobu et al. (2008) succeeded in preparing polyesters from 2-pyrone-4,6 dicarboxylic acid, a chemically stable metabolic intermediate of lignin for the first time utilized [10]. Shigehara et al. (2001) also succeeded in producing PDC polyamide as a novel polymer chemicals via the 2-pyrone-4,6-dicarbonyl dichloride derivative [11]. In this study, several low-molecular phenolic compounds which can be substrates for the fermentation to obtain PDC (PDC precursors) were prepared by alkaline subcritical water extraction of oil palm biomasses. Recently, subcritical water has been extensively developed in various fields of green technology; engineering and material research [12]. Subcritical water extraction is an eco-friendly method using only water. The determination of PDC precursors is made using

high performance liquid chromatography (HPLC). HPLC offers selectivity, resolution, speed and sensitivity far superior compared to classical techniques such as paper chromatography [4]. Reversed-phase HPLC with UV/VIS detector provides powerful and economical tool for phenolic compounds analysis in plant extracts [14]. The aim of this study is to obtain information for future experiments in producing PDC-based materials, and analyses the distribution of phenolic compounds in oil palm biomass.

METHODOLOGY

Plant material and sample preparation

Oil palm materials (*Elaeis guineensis*) were harvested from Dusun Durian, Banting Selangor cultivar type Deli Dura x AVROS in August 2008. The part that was used for this research is from inner part of oil palm trunk. The samples were reduced in size by chipping and later freeze dried until all the water completely removed and still maintaining the important characteristics of morphology, solubility, and chemical integrity. The shrinkage of gel structure and hydrogen bonding that occur during drying from water should also be avoided [2]. The samples were then grounded into sawdust with size range 250-500 µm using grinding machine.

Alkaline subcritical water extraction

Alkaline extraction with steaming equipment was conducted. The steaming equipment was composed of temperature controller, band heater, pressure gauge, and pressure tight cell TVS-1 (Taiatsu Techno Inc., Tokyo, Japan; 150 mL capacity; maximum temperature, 200˚C). About 1 g of powder was used for extraction, and 0.7 g for measuring moisture content. The samples from inner part were undergoing steaming extraction to determine optimum condition of extraction. The extraction were measured at 200^{0}C, 180ºC, 160˚C, 140˚C, 120˚C, 100˚C and 70˚C for temperature ; 5min, 10min, 20min, 30min and 40min for time ; 25ml, 50ml, 75ml and 100ml for volume of 0.1MNaOH solution. NaOH solution was prepared in three different molarities, which is 0.1M, 0.05M and 0.025M.

HPLC analysis of *Elaeis guineensis* extract

After steaming extraction, the extract was centrifuged about 20 minutes at 6000 rpm. This was followed by filtrating with 5 ml syringe cellulose acetate 0.45 µm disposable syringe filter unit. Then 10 micro liters (µl) of the extracts were used for HPLC analysis [15]. Separation was achieved using a LC column, Shim-pack, CLC – ODS (M) 25 cm. The HPLC analysis process had successfully isolated PDC precursors with the best separation was obtained using the following gradient: mobile phase (water/MeOH) =85/15, v/v; flow rate = 1.0 ml/min; temperature = 40^{o}C, total retention time = 40.01 min. Peak testing and detection at 280 nm and 360 nm were accomplished [8][9]. Standard solution for PDC precursors was prepared before the sample analyses, that is, gallic acid, 3,4,5-trihydroxybenzaldehyde, protocatechuic acid, protocatechuicaldehyde, *p*-hydroxybenzoic acid, *p*-hydroxybenzaldehyde, vanillic acid, caffeic acid, syringic acid, vanillin, syringaldehyde, *p*-coumaric acid, ferulic acid and sinapic acid were prepared by dissolving the compounds together in distilled water.

RESULTS AND DISCUSSIONS

The determination of phenolic compounds with available standard (Fig. 1) was carried out by comparing the chromatogram of standard mixtures and the samples. The peak identify confirmation was done by the comparison of both retention time and the pattern behaviour obtained from the chromatogram.

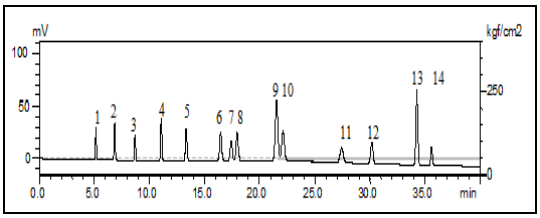


Figure 1: The chromatogram of HPLC standards. Gallic acid (1), 3,4,5-trihydroxy-benzaldehyde (2), protocatechuic acid (3), protocatechualdehyde (4), *p*-hydroxybenzoic acid (5), *p*-hydroxybenzaldehyde (6), vanillic acid (7), caffeic acid (8), syringic acid (9), vanillin (10), syringaldehyde (11), *p*-coumaric acid (12), ferulic acid (13), sinapic acid (14). Column: Shimadzu Shim-pack CLC-ODS(M) (250 × 4.6 mm i.d.). A linear gradient elution of Eluents A (10 mM aqueous phosphoric acid) and B (methanol), eluent B % (min), 15% (0) – 20% (3) – 20% (20) – 50% (40). Flow rate, 1.0 mL/min.

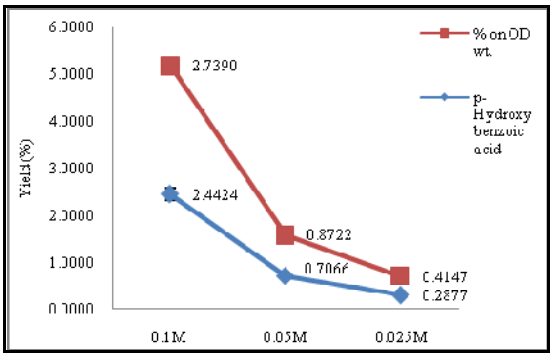


Figure 2: Graph of total % on OD weight and % of p-Hydroxybenzoic acid for HPLC analysis based on molarity.

The yield of total PDC precursors was the highest at 0.1M of NaOH, and the yield of *p*-hydroxybenzoic acid was the highest among ten kinds of PDC precursors (Fig. 2). From this results, we continued to determine another parameter using 0.1M NaOH.

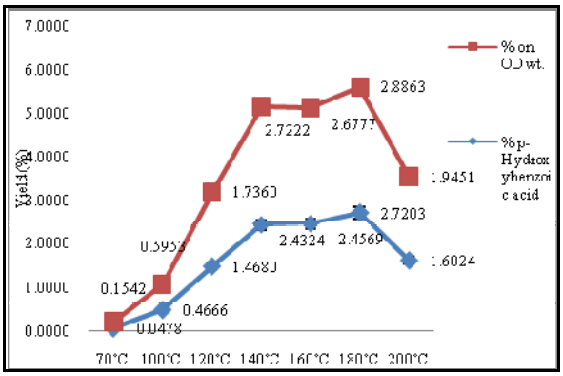


Figure 3: Graph of total % on OD weight and % of p-Hydroxybenzoic acid for HPLC analysis based on temperature.

The alkaline subcritical water extractions were conducted at 70˚C–200˚C (time, 5 min; volume of solution, 50 mL). Results are summarized in Fig. 3. From the graph, we can see that 180˚C give the highest yield compared to all temperatures which is the value is 2.8863%. The main compound presence was p-Hydroxybenzoic acid from retention time in the range between13-14 min based on HPLC analyses. 140˚C and 160˚C had almost same yield (2.4324% and 2.4569%). The yield increase with the increase of temperature, and decreases at 200˚C.

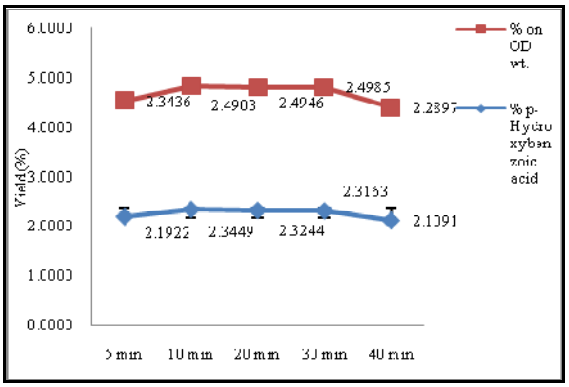


Figure 4: Graph of total % on OD weight and % of p-Hydroxybenzoic acid for HPLC analysis based on time.

The alkaline subcritical water extractions were conducted for 5–40 min (temperature, 180˚C; volume of solution, 50 mL). Results are summarized in Fig 4. The yields of both total PDC precursors and *p*-hydroxybenzoic acid were the highest at 10–30 min. From that we can conclude that the time between 20 min is mostly the optimum time for this kind of extraction.

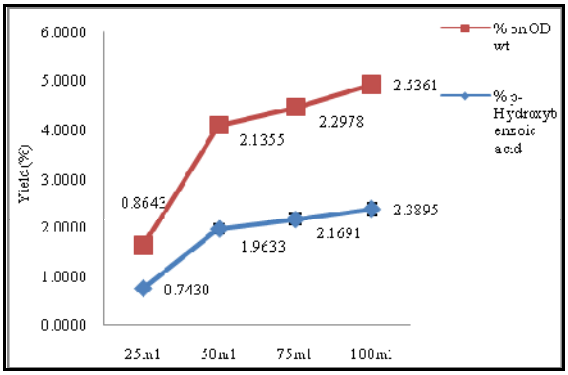


Figure 5: Graph of total % on OD weight and % of p-Hydroxybenzoic acid for HPLC analysis based on NaOH solution.

The alkaline subcritical water extractions were conducted with 25–100 mL water (temperature, 180˚C; time, 20 min). Results are summarized in Fig 5. The yields of PDC precursors were high in 100 ml of solution. The results proved the optimum condition of the alkaline subcritical water extraction for oil palm trunk meal to be as follows: molarity, 0.1M; temperature, 180˚C; time, 20 min; and NaOH solution, 100ml.

CONCLUSION

In this study, the alkaline subcritical water extraction of oil palm was carried out for the first time to determine the optimum condition. We found the best condition of this kind of extraction is molarity, 0.1M; temperature, 180˚C; time, 20 min; and NaOH solution, 100ml.

ACKNOWLEDGEMENT

The authors would like to acknowledge JIRCAS for partly supported the project and Universiti Sains Malaysia for the Fellowship of Nur Syahirah Saary. We are also truly thankful to IPS, USM for funding to attend this conference. Also to Sime Darby Research Centre Banting, Malaysia in the assistance of getting oil palm samples.

REFERENCES

[1] Alriols M.G., Tejado A., Blanco M., Mondragon I., Labidi J. Agricultural palm oil tree residues as raw material for cellulose, lignin and hemicelluloses production by ethylene glycol pulping process. *Chemical Engineering Journal* CEJ-5923 (2008).

[2] Browning, B.L. *Methods of wood chemistry*, Volume 1. Pp. 21. John Wiley & Sons, Inc., New York (1967).

[3] Chew, T.L., Bhatia, S. Catalytic processes towards the production of biofuels in a palm oil and oil palm biomass-based biorefinery. *Bioresource Technology*, Vol 99, Issue 17, Pages 7911-7922 (2008).

[4] García, A., Brenes, M., Romero, C., García, P. and Garrido, A. Study of phenolic compounds in virgin olive oils of the Picual variety. *European Food Research and Technology,* 215**,** 407-412 (2002).

[5] Goldstein, I.S. *Organic Chemicals from Biomass*. Pp. 10-13. CRC Press, Inc, Boca Raton, Florida (1978). .

[6] Higuchi, T. *Biosynthesis and Biodegradation of Wood Components*. Pp. 141. Academic Press, Inc(1985).

[7] Jouannic, S., Argout, X., Lechauve, F., Fizames, C., Borgel, A., Morcillo, F., Aberlenc-Bertossi, F., Duval, Y., Tregear, J. Analysis of expressed sequence tags from oil palm *(Elaeis guineensis)*. *FEBS Letters* 579 (2005) 2709 – 2714. (2005).

[8] Kawamura, F. Saary, N.S., Hashim, R., Sulaiman, O., Hasida, K. Otsuka, Y., Nakamura, M., Ohara, S. Preparation of 2-pyrone-4, 6-dicarboxylic acid (PDC) precursor from oil palm*. Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry* (2009).

[9] Kawamura, F., Hashida, K., Hashim, R., Sulaiman, O., Ohara, S., Otsuka, Y. and Nakamura, M. Preparation of precursor of 2-pyrone—4, 6-dicarboxylic acid (PDC) from Malaysian timbers. *Abstract of the 57th Annual meeting of the Japan Wood Research Society* p.141. ISSN 0549-3994 (2008).

[10] Michinobu, T., Hishida, M., Sato, M., Katayama, Y., Masai, E., Nakamura, M., Otsuka, Y., Ohara, S., Shigehara, K.Polyesters of 2-pyrone-4,6-dicarboxylic acid (PDC) obtained from a metabolic intermediate of lignin. *Polym. J*. 40, 68-75 (2008).

[11] Otsuka Y., Nakamura M., Shigehara K., Sugimura K., Masai E., Ohara S., Katayama Y. Efficient production of 2-pyrone-4,6-dicarboxylic acid as a novel polymer-based material from protocatechuate by microbial function. *Biotechnological Products and Process Engineering* 71, 608-614 (2005).

[12] Pourali, O., Asghari, F. S. and Yoshida, H. Production of phenolic compounds from rice bran biomass under subcritical water conditions. *Chemical Engineering Journal,* 160**,** 259-266 (2010).

[13] Sjőstrőm E. Wood Chemistry, Fundamentals and Applications. 77-78. *Academic Press, USA* (1981).

[14] Tasioula-margari, M. and Okogeri, O. Simultaneous determination of phenolic compounds and tocopherols in virgin olive oil using HPLC and UV detection. *Food Chemistry,* 74**,** 377-383 (2001).

[15] Wilkes, S., Glasl, H. Isolation, characterization, and systematic significance of 2-pyrone-4,6-dicarboxylic acid in *Rosaceae*. *Phytochemistry*, 58 (2001) 441-449. (2001).

Crab and Cockle Shells as Heterogeneous Catalysts in the Production of Biodiesel

Gaanty Pragas Maniam[1,*], Peng-Lim Boey[1] and Shafida Abd Hamid[2]

[1]School of Chemical Sciences, Universiti Sains Malaysia, 11800 USM, Penang, Malaysia.
[2]Kulliyyah of Science, International Islamic University Malaysia, Jalan Istana, Bandar Indera Mahkota, 25200 Kuantan, Pahang, Malaysia.
*gaanty@hotmail.com

Abstract

In the present study, the waste crab and cockle shells were utilized as source of calcium oxide to transesterify palm olein into methyl esters (biodiesel). Characterization results revealed that the main component of the shells are calcium carbonate which transformed into calcium oxide upon activated above 700 °C for 2 h. Parametric studies have been investigated and optimal conditions were found to be catalyst amount, 5 wt.% and methanol/oil mass ratio, 0.5:1. The waste catalysts perform equally well as laboratory CaO, thus creating another low-cost catalyst source for producing biodiesel. Reusability results confirmed that the prepared catalyst is able to be reemployed up to five times. Statistical analysis has been performed using a Central Composite Design to evaluate the contribution and performance of the parameters on biodiesel purity.

Keywords

Biodiesel; Heterogeneous catalyst; Transesterification; Methyl esters; Crab shell; Cockle shell

INTRODUCTION

In the period of 1970-2004, global emissions of greenhouse gases have increased as high as 70%, from 28.7 to 49.0 Gigatonnes of carbon dioxide-equivalent [1]. With the consciousness, the use of less-polluted energy sources is of scientists' recent interest. Biodiesel, a long-chain fatty acid methyl ester, a less-polluted energy source could be the best substitute or blending portion to the relatively more polluted conventional diesel fuel. The current oil consumption of about 86 million barrels per day and the limited oil reserves has positioned biodiesel as a future fuel for diesel engines. Biodiesel is prepared via a catalytic reaction between triglycerides and alcohol. Glycerol is the by-product of the reaction. The reaction involves the breakage of the glycerol structure and exchanges of alkyl groups between the alcohol and ester part of the triglyceride molecule; as such, the reaction is known as transesterification. Transesterification is a catalyzed reaction, where hydroxides, and also oftenly methoxides, of sodium and potassium are the popular choices for their excellent ability to catalyze the reaction. However, this type of catalyst is not able to be reused and requires tedious washing and separating steps, hence, stimulating the conception of heterogeneous-catalyzed transesterification [2]. Furthermore in homogeneous-catalyzed reactions, the quality of feedstock is of serious consideration in term of free fatty acid (FFA) and moisture content. In contrast, heterogeneous catalysts could tolerate these two impurities which are usually presence in waste and used oils. In addition, the utilization of waste materials as heterogeneous catalysts has been of recent interest in the search for a sustainable process [3,4]. As such, this paper demonstrates the use of waste bio sources, crab and cockle shells as heterogeneous catalysts in transesterification of palm olein. The catalysts were characterized by BET, SEM-EDX, TEM, TGA and XRD. Results showed that upon thermal activation at 900 °C, the shells turned into calcium oxide, the active ingredient that catalyzed the reaction. To assess and understand the effect of the selected reaction variables, statistical analysis was performed using Central Composite Design.

EXPERIMENTAL

Materials

Methyl esters standards, internal standards and Hammett indicators of chromatographic grade were obtained from Sigma-Aldrich (Switzerland). Methanol and anhydrous sodium sulphate of analytical reagent grade were purchased from Merck (Darmstadt, Germany).

Catalyst preparation and characterization

Crab (*Scylla serrata)* and cockle *(Anadara granosa)* shells were obtained from the local market (Penang, Malaysia). The shells were cleaned to remove protein and other unwanted substances and washed thoroughly with warm water several times. It was then dried overnight in an oven at 105 °C. Crushed and powdered shell was then sieved (< 1 mm) before being subjected to heat treatment in a furnace (900 °C for 2 h). The basic strength of the activated catalysts was tested using Hammett indicators. The following Hammett

indicators were used: phenolphthalein (H_ = 8.2), 2, 4-dinitroaniline (H_ = 15) and 4-nitroaniline (H_ = 18.4). The surface analysis of the catalysts was examined using Micromeritics ASAP 2000. The sample was degassed at 105 °C prior to analysis and the adsorption of N_2 was measured at -196 °C; the catalyst was examined by thermogravimetric analysis (TGA) using the Mettler Toledo TGA/SDTA 851e instrument, from 30 to 900 °C with 20 °C /min heating rate, under N_2 environment; the particle size of the catalysts was measured using transmission electron microscopy (TEM) with a Philips CM12 equipped with image analysis system; X-ray diffraction (XRD) on Siemens Diffraktometer D5000 using Cu Kα radiation, 2θ range from 25° to 125° with step sizes of 0.1°, at a scanning speed of 1° min^{-1}; scanning electron microscopy coupled with electron dispersive X-ray (SEM-EDX) was obtained using the Leo Supra 50VP Field Emission SEM system with a 5 kV accelerating voltage.

Reaction

Transesterification reactions were performed in a 25 mL, 2-neck glass reactor with a condenser, immersed in a water bath. In a typical reaction, 10.0 g of oil was added onto the mixture of catalyst and methanol. The contents were refluxed under magnetic stirring for 3 h. Reaction parameters (methanol/oil mass ratio and catalyst amount) were studied to identify the optimum reaction conditions. At the end of experiment, the reaction mixture was allowed to cool, resulting in the glycerol to separate by gravity. A centrifuge (Hettich, Universal) (2,500 rpm, 15 min) was used to further separate the layers (methyl esters, glycerol and catalyst) and the uppermost layer of methyl esters was decanted and washed with warm distilled water to neutralize, and dried over anhydrous sodium sulphate. Residual methanol in methyl esters was evaporated out using a rotary evaporator (Rotavapor R II, Buchi, Switzerland) at 80 °C to obtain a pure methyl ester. Finally, the methyl esters were filtered through a 0.45μm syringe filter.

Methyl esters analysis

The fatty acid profile was determined using GC (Perkin-Elmer, Clarus 500), fitted with a polar capillary column (Supelco Wax, 30m x 0.32mm x 0.25μm) following EN 14103 procedure.

Statistical analysis

The central composite design (CCD) under response surface methodology was used to analyze the collected data statistically using Design-Expert® 8.0 (Stat-Ease, Inc., Minneapolis, USA).

RESULTS AND DISCUSSION

Catalyst characterization

The catalysts changed both the colour of phenonpthalein (H_ = 8.2) from colourless to pink and the colour of 2,4-dinitroaniline (H_ = 15) from yellow to mauve but failed to change the colour of 4-nitroaniline (H_ = 18.4). As such, the catalysts' basic strength was designated as $15 < H_ < 18.4$, and it was considered as a strong base for the transesterification reaction. TGA exhibits one major decomposition which can be attributed to the evolvement of CO_2 and the weight loss matched to the stoichimetrical weight loss of 44% when $CaCO_3$ transforms to CaO. SEM micrographs of calcined catalyst demonstrated many pores on its surface and the presence of similar morphologies explain its high catalytic activity. On the contrary, at equal magnifications of 5000x, uncalcined catalyst showed a bulky substance without any clear pores on its surface. The catalytical activity is further confirmed by the higher BET surface area of 11 to 14 m^2g^{-1} for calcined catalyst versus only about 2 m^2g^{-1} for uncalcined catalyst (Table 1). TEM particle sizes of the catalysts are about 25 nm as shown in Table 1.

Table 1. Physical properties of catalysts from different origins

Physical properties	Catalyst (CaO)	
	Crab	Cockle
BET surface area[a] (m^2g^{-1})	2.2	1.9
BET surface area[b](m^2g^{-1})	14.2	11.4
TEM particle size[b] (nm)	26 ± 11[c]	25 ± 10[c]

[a]Uncalcined catalyst
[b]Calcined catalyst at 900 °C, 2h
[c]Standard deviation of the mean value

XRD results revealed that the composition of uncalcined crab shell mainly consisted of $CaCO_3$ with the absence of CaO peak. However with the increase in activation temperature, $CaCO_3$ completely transforms to CaO by evolving the adsorbed CO_2. The composition of calcined catalyst at 900 °C mainly consisted of the active ingredient, CaO (Fig. 1). Narrow and high intense peaks of the calcined catalyst define the well crystallized structure of the catalyst. The findings are in line with EDX results, in which calcium is the major element in calcined catalyst and oxygen is the chief element in uncalcined catalyst. The observations insist that the catalyst has to be activated thermally before it can be used to catalyze the reaction.

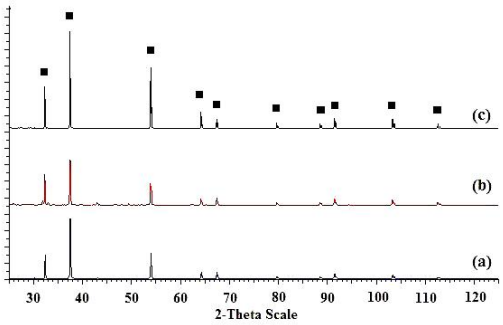


Fig. 1. Powder XRD patterns of the calcined (900 °C, 2 h) catalysts: (a) laboratory CaO, (b) crab shell and (c) cockle shell; ■, CaO

Reaction

Parametric study demonstrated that the optimal conditions for reactions catalyzed by the shells were: methanol/oil mass ratio 0.5:1 and catalyst amount 5 wt.%, reaction time of 3 h at methanol refluxing temperature. Under the optimal conditions, thermally activated shells gave an acyl conversion of more than 98%.

Statistical analysis

The statistical Model Fit Summary (which consists of sequential model sum of squares and lack of fit tests) suggests that the quadratic model is the best fit-model. Furthermore, from the Analysis of Variance (ANOVA), the "Prob > F" value for the quadratic model was significant (<0.0001). Values of less than 0.1000 indicate model terms are significant. The model indicates that the catalyst amount is the most important positive factor in determining the purity as compared to the other factor, MeOH/oil mass ratio.

Reusability of the prepared catalyst

Under the optimized conditions (5 wt.% catalyst and 0.5:1 methanol/oil mass ratio), the prepared catalyst was able to be reused at least for five times, with a purity above 96.5%; the minimum requirement of methyl ester content under EN 14214:2003, and a yield above 97%. Before reuse, the spent catalyst was washed with methanol and n-hexane to remove the adsorbed materials and calcined at 900 °C for 2 h. The washed uncalcined spent caltalyst was consist of $Ca(OH)_2$ and traces of calcium diglyceroxides. However, upon calcinations at 900 °C for 2 h, the structure of catalyst has changed to CaO, the active species that catalyzed the reaction, and traces of $Ca(OH)_2$.

CONCLUSIONS

Thermally activated waste crab and cockle shells have been successfully utilized as catalysts in the transesterification of palm olein into biodiesel. Optimized conditions were found to be 5 wt.% catalyst and 0.5:1 MeOH:oil mass ratio.Their performances were well matched with laboratory CaO, demonstrating the origin of CaO has no effect on its performance as a solid catalyst in transesterification reaction. Furthermore, the prepared catalyst was able to be reused up to five times without much deterioration in its activity, thus creating another low cost catalyst source for biodiesel production. Information derived from the statistical analysis assisted in understanding the role of each variable in determining the purity of the product.

ACKNOWLEDGMENTS

Financial support by Universiti Sains Malaysia (USM) under USM-RU-PRGS Grant (1001/PKIMIA/841005) and the award of USM Fellowship (G.P. Maniam) are gratefully acknowledged. Further, we are thankful to the Institute of Postgraduate Studies (IPS), Universiti Sains Malaysia for funding the conference (ICPE-4, 2010) participation. The authors would also like to thank Stat-Ease, Inc., Minneapolis, USA for their support in providing the statistical software.

REFERENCES

[1] World Energy and Climate Policy: 2009 Assessment. Retrieved from: www.worldenergy.org (accessed on 1 May 2010).

[2] Lee, D.-W., Park, Y.-M., Lee, K.-Y., *Catal. Surv. Asia* 13 (2009) 63-77.

[3] Boey, P-.L., Maniam, G.P., Hamid, S.A., *Bioresour. Technol.* 100 (2009) 6362-6368.

[4] Boey, P-.L., Maniam, G.P., Hamid, S.A., Ali, D.M.H., *J. Am. Oil Chem. Soc.* (2010) doi: 10.1007/s11746-010-1660-4.

Premilinary Study of Oil Palm Trunk Sap and Starch Content from Various Cultivars at a Different Storage Time

Zubaidah Aimi Abdul Hamid[1*], O. Sulaiman[1], R. Hashim[1], T. Arai[2], Y. Mori[2], R. Tanaka[3], A. Kosugi[2], Y. Murata[2], and K. Yamamoto[3]
[1]Bioresource, Paper and Coatings Technology Division, School of Industrial Technology, Universiti Sains Malaysia, 11800, Penang, Malaysia
[2]Post-Harvest Science and Technology Division, Japan International Research Center for Agricultural Sciences (Jircas), Japan
[3]Department of Biomass Chemistry, Forestry and Forest Products Research Institute, Japan
[*]E-Mail Address: zubaidahaimi@yahoo.com

ABSTRACT
In this study, sugar content and starch of two cultivar of oil palm namely Dura x Pisifera mix (dura x URT) and Dumpy x Yangambi x AVROS were investigated based on different storage time (0, 15, 30, 45, 60 and 75 days). HPLC method was used to determine the total sugar and individual sugar content. The analysis of total sugar showed sugar content was found to increase after certain of storage time (30 - 60 days) around 11.7-13.7% for a cultivar Dura x Pisifera mix (dura x URT) and 10.4-11.4% for Dumpy x Yangambi x AVROS. Starch content was found to decrease progressively as the storage duration became longer.

Keywords
Oil palm trunks, Oil palm biomass, Starch, Sugar, Storage.

INTRODUCTION
The oil palm or *Elaeis guineensis* Jacq. belongs to the family *Palmae* and has been found to grow wild at West Africa [1]. It produced 90% of biomass from the trunks part and could easily be obtained from replanting activities [2, 3]. The oil palm is a monocotyledon with different properties from that of hardwood and softwood. Basically, oil palm trunks (OPT) consist of parenchyma with fibrous strands and vascular bundle [4, 5]. The parenchyma of oil palm trunks contain abundant of starch [5].

OPT contain high moisture content also known as a sap which could be as high as 500% [4]. This sap contains sugar and could subsequently be converted to ethanol by fermentation. This fermentable sugar can be in the form of sucrose, glucose and fructose.

The main objectives of this study are to analyze the fermentable sugar content and starch content and of the pressed sap samples from felled oil palm trunks at a different cultivars and duration of storage.

MATERIALS AND METHODS

Samples preparation
Oil palm trunks (OPT) with two different types of cultivars were obtained from KLK, Malaysia Northern Branch located in Kedah, Malaysia (Dumpy x Yangambi x AVROS) and MKC Enterprise located in Felda Kelating Jernih, Serting Hilir, at Negeri sembilan, Malaysia (Deli Dura x Pisifera X H&C). The trees were planted in 1981 and 1997, respectively, and were cut at 8 feet length from middle part of OPT. The samples were stored under the shade and were cut into discs according to the schedule of the cutting plan and prepared accordingly based on standard method.

Determination of sugar and starch content
Total sugar content of sap samples was determined by the Dubois method using phenol and sulfuric acid [6]. Absorbance of the solution was recorded at 480 nm. The calibration was carried out with glucose as standard. Determination of sugar components in each sap was carried out by high performance liquid chromatography (HPLC). Distilled water was used for the mobile phase at a flow rate of 0.4 ml min^{-1}.

For analysis of starch, a small amount of each sectional OPT sample was prepared in powder form by grinding and sieve using mesh size 200 before drying. Then, 0.400 g dry sample was weighed and 4.7 ml of 7.2M perchloric acid was added. The samples were then diluted with distilled water and centrifuged before 10ml aliquot were taken for analysis. The amount of starch present was determined by calibrating the absorption at wave length 650 nm with UV spectrophotometer, Shimadzu UV-1201 [7].

RESULT AND DISSCUSSION
The sugar analysis is indicated in Table 1. The results showed the composition of sugars at various storage times. Sucrose, glucose and fructose form as a main free sugar present in OPT. Glucose has a highest constituent of sugar of about 1.82%-7.77%

(Dura x Pisifera mix (dura x URT)). and 2.35% and 5.80% for samples from (Dumpy x Yangambi x AVROS). Other short chain polysaccharides such as maltose, xylose, galactose, arabinose and inositol also present in a small quantity from a total amount of sugar inside the OPT.

Sugar content increased as the storage time increased. The highest total sugar content was found for 60 day storage with 13.9% and 11.72% for sample from Dura x Pisifera mix (dura x URT) and Dumpy x Yangambi x AVROS.

Starch content of Dumpy x Yangambi x AVROS OPT was higher (0.001%-0.65%) compared to Dura x Pisifera mix (dura x URT) (0.01%-0.11%).

Table 1: Summary of sugar and starch content after storage time for different cultivars

			Sugar content					Starch content
			Composition of sugar (%)				Total sugar	
Cultivars	Days	Parts	Sucrose	Glucose	Fructose	Other free sugars	(%)	(%)
Dura x Pisifera mix (dura x URT)	0	A	1.77	3.47	0.39	0.26	5.89	0.34
		B	1.73	2.83	0.39	0.24	5.18	0.37
		C	1.54	1.84	0.66	0.84	4.87	0.39
	15	A	2.43	4.14	2.18	0.58	9.33	0.23
		B	2.96	3.57	2.26	0.55	9.33	0.20
		C	2.21	2.93	2.16	0.52	7.83	0.22
	30	A	1.36	6.06	3.42	0.81	11.6	0.10
		B	1.69	5.25	3.65	1.15	11.7	0.12
		C	1.58	5.28	3.71	1.16	11.7	0.12
	45	A	2.04	6.36	3.55	0.70	12.6	0.07
		B	2.99	5.84	3.68	0.86	13.3	0.07
		C	2.66	5.27	3.68	1.04	12.6	0.05
	60	A	1.95	7.00	3.66	0.79	13.4	0.02
		B	2.79	6.33	3.86	1.02	13.9	0.02
		C	2.67	6.44	3.88	1.01	14.0	0.01
	75	A	1.67	7.78	2.80	0.72	12.9	0.01
		B	1.81	6.14	2.85	0.74	11.5	0.02
		C	3.31	5.02	2.34	0.36	11.0	0.01
Dumpy x Yangambi x AVROS	0	A	3.15	3.85	0.88	0.04	7.92	0.65
		B	5.15	3.74	0.77	0.23	9.88	0.61
		C	3.90	2.35	1.18	0.33	7.76	0.59
	15	A	2.56	4.50	1.23	0.08	8.36	0.33
		B	2.38	5.28	2.35	0.77	10.7	0.31
		C	1.50	4.74	3.46	1.17	10.8	0.28
	30	A	1.46	5.70	2.62	0.10	9.89	0.09
		B	1.00	5.75	2.43	0.73	9.91	0.07
		C	1.31	5.80	2.82	1.13	11.0	0.09
	45	A	4.35	5.13	1.51	0.08	11.06	0.02
		B	2.82	5.53	2.10	0.66	11.10	0.06
		C	2.71	5.37	2.49	1.14	11.72	0.03
	60	A	4.87	5.31	1.54	0.08	11.80	0.04
		B	3.17	5.33	1.83	0.36	10.68	0.04
		C	3.47	5.53	1.83	0.66	11.49	0.04
	75	A	1.23	3.60	2.04	0.03	6.90	0.01
		B	2.68	4.11	1.48	0.22	8.50	0.01
		C	3.90	5.00	1.45	0.39	10.75	0.01

CONCLUSION

In this study, oil palm sap has been analyzed for its sugar amount and composition. The sugar content was found to increase as the storage time increased until 30-60 days. Glucose was the highest sugar content followed by sucrose and fructose. Starch content decreased as the storage time increased.

ACKNOWLEDGEMENT

The authors would like to acknowledge JIRCAS through New Energy and Industrial Technology Development Organization *(NEDO) grant* for partly supported the project and Universiti Sains Malaysia (USM) for the Fellowship of Zubaidah Aimi Abd Hamid. We are also truly thankful to Institute of Post Graduate Studies, USM for funding to attend this conference. Our appreciation also goes to KLK, Kepong, Malaysia, Northern Branch and MKC Enterprise for the oil palm samples.

REFERENCES

[1] Rahim, S., Abdul Razak, M.A.,1987. Chemical component in oil palm trunks influencing wood cement board manufactures. Paper presented at the Asian Science and Technology Congress, 14-17th October 1987, Kuala Lumpur.

[2] Lin, Y., Tanaka, S., 2006. Ethanol fermentation from biomass resources: Current state and prospects. Applied Microbiology and Biotechnology 69, 627 – 642.

[3] Sun, Y., Cheng, J., 2002. Hydrolysis of lignocellulosic materials for ethanol production :a review. Bioresource Technology 83(1): 1-11.

[4] Lam, M.K., Tan, K.T., Lee, K.T., Mohamed, A.R., 2009. Malaysian palm oil: Surviving the food versus fuel dispute for a sustainable future. Renewable and Sustainable Energy Review 13, 1456-1464.

[5] Lim, K.O., Ahmaddin, F.H., Vizhi, S.M., 1997. A note on the conversion of oil palm trunks to glucose via acid hydrolysis. Bioresource Technology 59(1):33-35.

[6] Dubois M, Gilles KA, Hamilton JK, Robers PA, Smith F. Colorimetric method for determination of sugars and related substances. Anal Chem 1956;28:350-6.

[7] Humphreys, F.R., Kelly, J., 1961. A method for determination of starch in wood. Anal. Chim. Acta, 24, 66-70.

Automatic 3D Landmarks Detection and Placement on Craniofacial Data

Pan Zheng[1], Bahari Belaton[1] , Iman Yi Liao[1] and Zainul Ahmed Rajion[2]
[1]School of Computer Sciences, Universiti Sains Malaysia, Penang
[2] School of Dental Sciences, Universiti Sains Malaysia, Kubang Kerian
panzheng@gmail.com, bahari@cs.usm.my, iman@cs.usm.my, zainul@kck.usm.my

Abstract
Landmarks identification and placement on craniofacial data are more of art than science. The tasks are tedious, time-consuming and very often depend on one's previous experiences. In this study, we provide a systematic 3-fold method to identify the landmarks on craniofacial data. The method includes surface synthesis, feature line extraction and landmark placement. In first phase, an implicit polygonizer is enhanced and modified to suit the needs of surface formation from CT scan generated data, meanwhile the data preprocessing is done. The feature lines concerned in the second phase are crest lines which are formed by the zero-crossing of surface extremum. In the third phase, we transfer the idea of corner detection in the 2D domain of image processing to a 3D perspective in our development.

Keywords
landmarks identification, visualization, craniofacial feature detection.

INTRODUCTION

Craniofacial deformity is one of the major concerned areas of dental science. it can be caused by physical damage in accidents and congenital abnormality such as cleft lip and palate whose proportion of new born babies in Hospital of Kuala Lumpur is said to be 7.6/10,000 [1]. All these require carefully planned surgery. Before a surgery, a detail diagnose has to be conducted to identify the anatomical structures which bring us a definition of craniofacial landmarks, or some researchers might call it craniometric points. A craniofacial landmark is an anatomical structure used as a salient point of origin in locating other anatomical structures or as a point from which measurements can be taken in a human skull.

Conventionally when a case of head/skull damage comes to a surgeon, the surgeon establishes a surgery plan in a timely manner. For reconstructing the damage part, surgeons marks the craniofacial landmarks mostly by their previous experiences with certain level of arbitrariness due to time constrains. These days Computed Tomography and Magnetic Resonance Imaging are widely used to help diagnose the situation. Information is, however, not sufficient enough for giving a very accurate solution. Based on above scenario, a method of automatic identifying craniofacial landmarks for accurate skull reconstruction surgery planning is highly demanded.

Moreover, there are some potential needs of plastic surgeries for certain group of people. Craniofacial registration and reconstruction is also vital for forensic studies. Modern 3D games and human form virtual reality figures might be benefit from this research.

RESEARCH DESIGN AND METHODOLOGY

In the domain of analytical problem solving, it is a common practice to reduce the dimension of a complicated issue to achieve a optimal solution. This principle seemly conforms to our study.

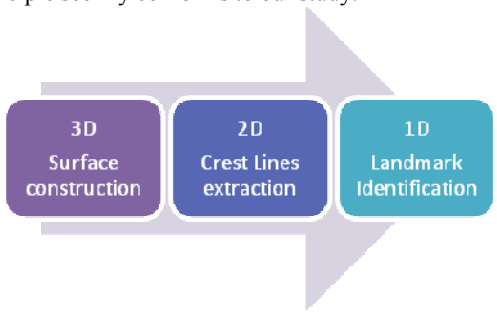


Figure 11 Overall Research Design

The 3-fold method we proposed follows the idea (Figure 1). In this process, CT generated DICOM data serves as input. After data preprocessing, we use modified implicit polygonizer [2, 3] to construct the surface. Implicit polygonizer is considered because it is a cube traversal surface construction method and it has major advantages over conventional exhausted surface extraction methods. It has a complexity approximated to $O(n^2)$, whereas conventional implementations generally have a complexity of $O(n^3)$. The second phase is to extract feature lines on the 3D surface. The feature lines we concerned are crest lines which are 2D manifold and show the prominent characteristics of an object surface. We first developed a heuristic method to extract the feature lines formed by the zero crossing of 3rd order derivatives of each vertex of surface triangle patches. The result is not consistent. Therefore we investigate concept of crest lines [4]. Crest lines extraction heavily replies on the accuracy of geometry properties of a surface. These properties are normal vectors, principal direction and principal curvatures.

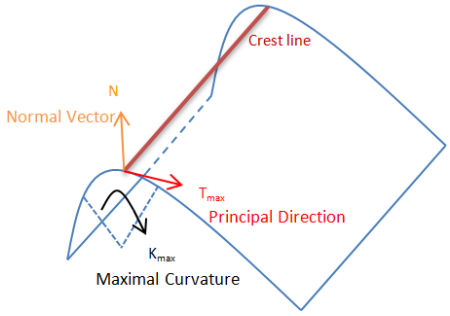


Figure 12 Crest Line

Crest lines of a surface is formed by connecting the zero crossing of extremal value e_{max} of each vertices of a triangle patch of an isosurface. In figure 2, k_{max} is the maximal principal curvature and t_{max} is the principal direction.

$$e_{max} = \vec{\nabla} k_{max} \cdot \vec{t_{max}}$$

Above formula gives the gradient of principal curvature in principal direction.

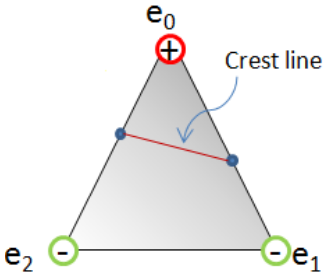


Figure 13 Crest points and crest line on a simple triangle patch

After obtaining e_{max} for each vertex of the surface, within a single triangle patch, circled red in figure 3. The sign of e_{max} is evaluated. If all three emax are in same sign then there is no zero-crossing on any edge of the triangle. Whereas if there is an e_{max} of a vertex is in different sign then it guarantee a zero-crossing on the edges of a triangle patch. Linear interpolation is applied to each triangle patch of the isosurface to identify the extremal points on the edge. The crest lines can be formed then.

The 3rd phase is to use corner detection to location crucial features on the extracted feature lines. Corner detection is commonly and widely used in the field of image processing. The technique is normally applied to 2D image. In our study, we extend this idea to a 3D perspective to facilitate our solution. The 3rd phase of this study is still on-going.

IMPLEMENTATION RESULT AND DISCUSSION

In this study, we use several programming packages and mathematical modeling tools such as Visualization Toolkit (VTK), OpenGL and MATLAB.

The data preprocessing is done by using VTK to convert the CT-scan generated DICOM data to ASCII data to be further handle by OpenGL/C and MATLAB. In this processing, sensitive information of patients are removed.

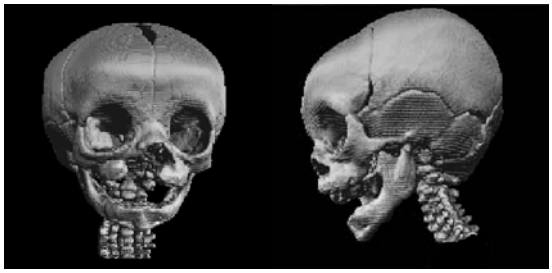


Figure 14 Implicit Polygonizer Generated Craniofacial Surface

Figure 4 shows a craniofacial surface of an infant generated by modified implicit polygonizer.

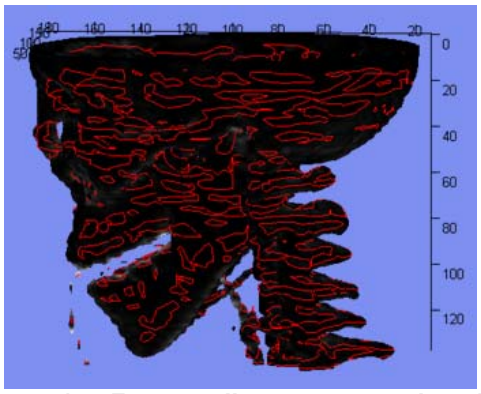


Figure 15 Feature lines generated using heuristic method

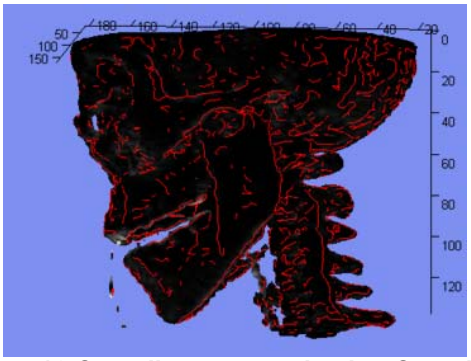


Figure 16 Crest line extracted using Crest line Algorithm

Figure 5 and 6 show the different feature extract on craniofacial data of an infant.

As the research goes on, we also have developed prototype application to simulate the final optimized result. Figure 7 shows the landmark placement application developed by us. The application can be used for landmark placement, distance measurement between two arbitrary landmarks and angle measurements in any three landmarks. The application also provides an opacity control function which can be used to change the

transparency of the craniofacial data or even to make the data invisible so users can investigate the relation among landmarks only.

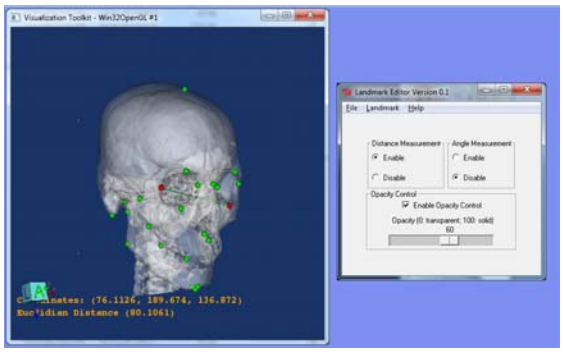


Figure 17 A Prototype Landmark Placement Application

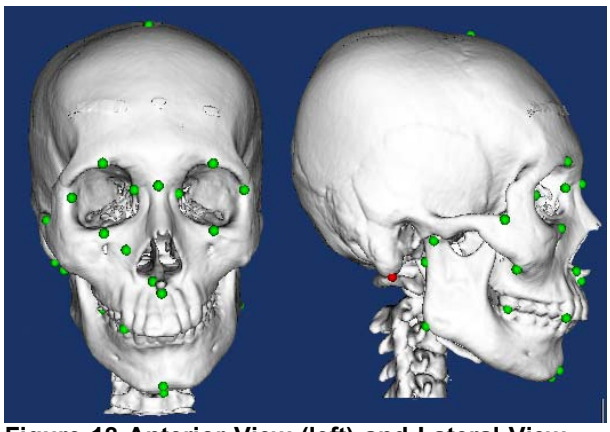


Figure 18 Anterior View (left) and Lateral View (right) of a Craniofacial Landmark Placement Sample

ACKNOWLEDGEMENT

We would like to thank IPS, Universiti Sains Malaysia to give supports and this opportunity to present this work. This research is funded by MOSTI Science Fund: 01-01-05-SF0045.

REFERENCES

[1] Noraihan, M. N., See, M. H., Raja, R., Baskaran, T. P., & Symonds, E. M. "Audit of birth defects in 34,109 deliveries in a tertiary referral center", *Medical Journal of Malaysia*, 60(4), (2005)460-468.

[2] Jules Bloomenthal, "Polygonization of Implicit Surfaces", *Computer Aided Geometric Design*, vol. 5 1988, pp. 341-355.

[3] Pan Zheng, Bahari Belaton, Iman Y.Liao, "Isosurface Extraction of Volumetric Data Using Implicit Surface Polygonization", *Proceeding of Third Asia International Conference on Modeling & Simulation*, 2009 pp. 555-559.

[4] J.-P. Thirion, A. Gourdon, "The 3D Marching Lines Algorithm", *Graphical Models and Image Processing*, Vol. 58, Issue 6, Nov. (1996), pp 503-509.

[5] M. Sarfraz, "Corner Detection for Curve Segmentation", *Interactive Curve Modeling*, Springer-Verlag London Limited (2008) pp209-240.

Hardware-in-the-Loop Simulation of Automatic Steering Control

Em Poh Ping[1,*], Khisbullah Hudha[1] and Hishamuddin Jamaluddin[2]
[1]Automotive Control System Laboratory, Department of Automotive Engineering,
Univeristi Teknikal Malaysia Melaka (UTeM)
[2] Department of Applied Mechanics,
Universiti Teknologi Malaysia (UTM), Johor, Malaysia
*embb842@hotmail.com

Abstract
This paper presents a 9 Degree-of-Freedom (DOF) vehicle model combined with a closed-loop driver model for developing vehicle lateral control. The proposed river model consists of a yaw effect adaptive fuzzy logic control. Stepper Motor Actuated Steering (SMAS) system is briefly introduced as an inner-loop subsystem. The Software-in-the-Loop Simulation (SILS) and Hardware-in-the-Loop Simulation (HILS) results show that the proposed driver model is capable of improving the Y-axis trajectory error and Y-axis trajectory maneuvers significantly and the proposed SMAS system is capable of tracking the desired steering angle position and producing the front wheel steer angle for the use of vehicle model.

Keywords
Hardware-in-the-loop simulation; Software-in-the-loop Simulation; Automatic steering control; Driver model; Double lane change

INTRODUCTION

The primary task of automatic steering is to track a reference path, where the displacement from the guideline is measured by a displacement sensor [1]. Instead of tracking a reference path guideline on the road, a driver model was developed to maneuver the vehicle that maneuvering on a predefined double lane change (DLC) trajectory path which acts as the reference path to be followed.
The aims of implement an automatic steering system are to improve the passive and active vehicle safety and vehicle dynamic performance. The automatic steering system is a system in which the mechanical steering column of the passive steering system and steering wheel were cut off and replaced by a stepper motor that receive commanded angle position signal from the driver model. The necessary angle position for the stepper motor is determined by the driver model based on the predefined maneuver paths.

In this study, the proposed driver model is a combination of proportional gain control with a delayed yaw effect adaptive fuzzy logic control. Adaptive fuzzy logic control [2] was used to adjust the driver model parameters and improve the performance online. Furthermore, adaptive fuzzy logic control is also used to adapt the dynamic behavior of the predefined maneuver trajectory tracking performance.

A Stepper Motor Actuated Steering (SMAS) system for automatic steering control is proposed and used to command the steering linkage to steer the front wheels based on the steering input from the driver model. The proposed inner-loop control strategy of the SMAS system is a combination of proportional-integral (PI) control with closed-loop positioning control.

This paper organized as follows: Section 1 contains the introduction and the review of some related works. Section 2 presents a 9-DOF vehicle model with Calspan tire model, and control design of the outer-loop driver model is presented in Section 3. Section 4 presents the Stepper Motor Actuated Steering (SMAS) system model coupled with the proposed inner-loop control structure. Section 5 presents the performance evaluation and validation of the proposed driver model and SMAS system through SILS and HILS, and finally the conclusions are in Section 6.

VEHICLE MODEL WITH CALSPAN TIRE MODEL

The vehicle model of a passenger vehicle considered in this study consists of a single sprung mass that is connected to four unsprung masses and is represented as a plane that allows pitch, roll, and yaw as well as displacement in lateral and longitudinal directions as shown in Figure 1. Each wheel is also permitted to rotate around wheel axle axis and only the two front wheels are free to steer.

Some of the modeling assumptions considered in this study are as follows: the ride model subsystem of the vehicle model is based on [3] vertical force equations. Tire vertical behavior is represented by Calspan tire model. The vehicle body is lumped into a single mass represented by sprung mass and displacement in the vertical direction is ignored. The vehicle remains grounded at all times and four tires always in contact with the ground during maneuvering. The Ackermann principle is neglected for double lane change (DLC)

maneuver.

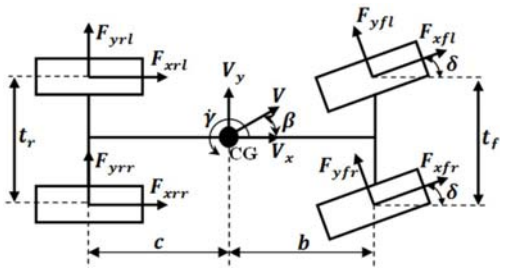


Figure 1: A 3-DOF vehicle handling model

OUTER-LOOP CONTROL DESIGN

The driver model implemented here is a modified version of the mathematical model of a comprehensive driver model proposed by [4]. In the following text only the major steps and main modifications are described; for more detailed explanation the reader is referred to the description of the original model. The driver model that carries out in this paper is main focus on the vehicle lateral control.

The proposed control structure of lateral control driver model is implemented on a verified full vehicle model as shown in Figure 2.

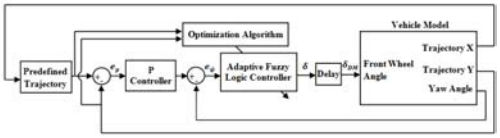


Figure 2: Vehicle outer-loop block diagram of the driver model

The vehicle model can be described as a 9-FOD system subject to excitation from steering input. It consists of 5 degrees of freedom from the vehicle body and one degree of freedom due to the rotational motion of each tire.

The control action that the driver model can do at ease and with least workload is the kind of action that gives output signal proportional to the input signal, referred as the proportional action. This is represented by the proportional gain, K_p. The steering angle, δ_{DM}, demanded by the lateral control driver model is calculated depending on the heading errors, e_ψ, between the road angle and vehicle yaw angle and on the path deviation errors, denoted by e_p, between the preview position on the road and future vehicle position obtained by linear interpolation. The errors are weighted by the control gains, denoted by K_p, and an adaptive fuzzy logic system, which resulting the steering angle.

For comparison, two driver models are used as the benchmark, which are McRuer & Krendel driver model [5] and Ragazzini driver model [6].

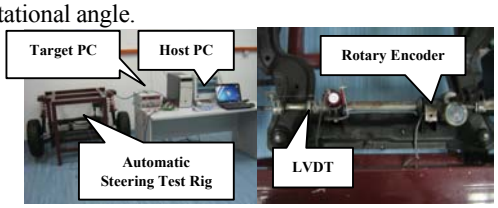
INNER-LOOP CONTROL DESIGN

The mathematical modeling of the inner-loop control for the steering system considered in this study consists of a stepper motor model [7], rack and pinion model, and kinematics model of steering system [8]. The stepper motor is represented as an actuator and is allowed to rotate at its rotational axis, as well as to rotate the pinion into the steering rack in linear motion at its axis. The linear motion of the steering rack is allowed to rotate the front wheels at its steering axis.

Some of the modeling assumptions considered in this study are as follows: the effect of steering inertia is neglected, the front left and right wheels are assumed to have identical wheel angle under excitation from steering input, the effect of backlash on the rack and pinion gearbox is neglected, the efficiency of the stepper motor's rotating shaft to pinion rotating shaft is neglected. The permanent magnet type stepper motor model used in this paper is directly referred to Morar, (2003).

The rotational motion of the pinion is converted into linear motion on the steering rack. The relation between the pinion and steering rack was identified by using the steering rack of a Malaysian National car through HILS testing (Figure 3a) on MATLAB xPC-TARGET environment. In HILS testing, rotary encoder (Figure 3b) is used to measure the rotational angle of the pinion. The linear variable differential transformer (LVDT) (Figure 3b) is used to measure the linear displacement of the steering rack.

Figure 4 shows the result gathered from HILS testing. In Figure 4, *Y*-axis represents the steering rack displacement; and *X*-axis represents the pinion angle. The dash line in the plotted graph shows a nonlinear behavior between to pinion angle, which is due to the backlash on the gearbox of the steering linkage mechanism. To simply the relation of the rack and pinion steering mechanism, the rack displacement is assumed to be directly proportional to the pinion rotational angle.



a) b)

Figure 3: a) Hardware-in-the-loop simulation testing setup, b) Instruments attached on the steering linkage

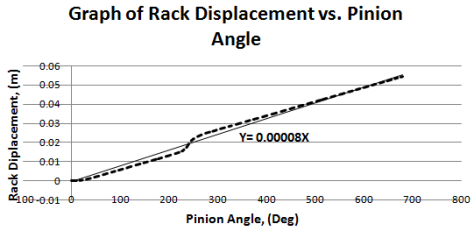


Figure 4: Rack displacement and pinion angle relation graph

The inner-loop controller structure is developed to command the stepper motor to actuate to the desired position given by the driver model and the actual position of the stepper motor is feedback and compared with the desired position. This is called closed-loop positioning control and with the hope that the stepper motor will closely follows the desired position. A proportional gain controller is placed between driver model and stepper motor model that blend the inner-loop and outer-loop controllers. The driver model provides the steering position control based on the predefined maneuver paths. The SMAS system provides the front wheels steer angle based on the desired steering position input from the driver model. The proposed SMAS system control structure is as shown in Figure 5.

Figure 5: Inner-loop block diagrams of SMAS system

PERFORMANCE EVALUATION AND VALIDATION OF THE PROPOSED OUTER-LOOP AND INNER-LOOP CONTROL

The performance evaluation of the outer-loop control driver model and inner-loop control SMAS system were examined through SILS study using MATLAB-SIMULINK software. Besides SILS, HILS is also simulated using xPC-TARGET and REAL-TIME WORKSHOP of the MATLAB software package for validation between experimental data and simulation data of outer-loop control driver model and inner-loop control SMAS system. For the purpose of comparison, the performance of the proposed driver model is compared with both conventional driver models approach through SILS. The validation of the proposed driver model and SMAS system were examined through vehicle handling motion namely *Y*-axis trajectory and *Y*-axis trajectory error under predefined trajectory for double lane change (DLC) maneuver at 80 km/h constant speed.

HILS is necessary for development of modern vehicle handling dynamics controller, which can be regarded as a standard method these days [9]. From literature, HILS is defined as the middle step between vehicle field test and software-in-the-loop (SILS) [10]. In this paper, HILS is proposed method to validate the developed automatic steering control, which consists of outer-loop driver model and inner-loop SMAS system.

The HILS of automatic steering test rig can be divided into two parts, namely hardware and software parts. Hardware parts are composed of xPC-TARGET, which is automatic steering test rig which includes commercial vehicle's steering rack and jaw coupling , stepper motor and switching driver circuit, rotary encoder, data acquisition PCI card, PCI based network card, crossover network cable, Host PC, Target PC, DC power supply, and input/output pinout board as shown in Figures 6 and 7.

Software parts include signal interface between Host PC and Target PC, xPC TARGET and REAL-TIME WORKSHOP software to control stepper motor and rotary encoder, Visual Studio 2008 Express as a C compiler, input-output signals on the pinout, outer-loop driver model, inner-loop SMAS system, and vehicle model as shown in Figures 8 and 9. The Target PC for this system was a Pentium 4 with 256 MB RAM.

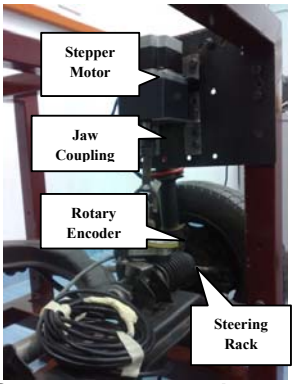


Figure 6: Stepper motor and rotary encoder attached on the automatic steering test rig

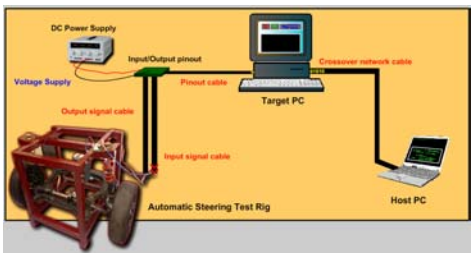


Figure 7: Schematic diagram of HILS setup

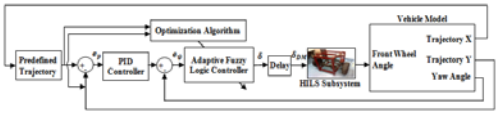


Figure 8: Integrated outer-loop and inner-loop control structure with HILS subsystem

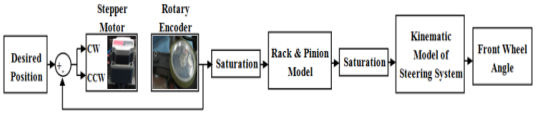
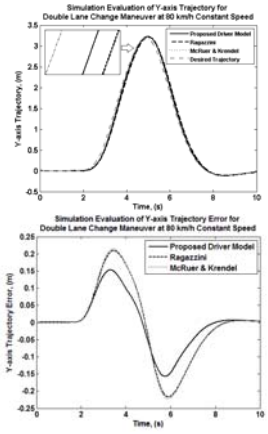


Figure 9: Components inside the HILS subsystem

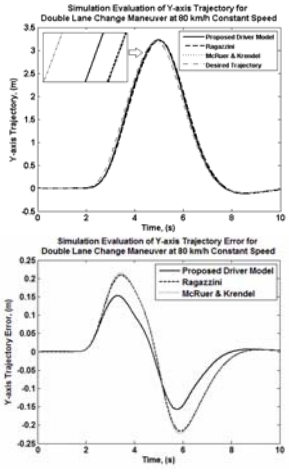
Figure 10(a) illustrates the *Y*-axis trajectory behaviors of the proposed driver model indicate

better performance and reduced *Y*-axis trajectory error during DLC maneuver compared with the benchmark driver models at 80 km/h constant speed. The trajectory reduced by the proposed driver model is the closest to the desired trajectory. Figure 10(b) shows clearly how the proposed driver model can effectively reduce the *Y*-axis trajectory error in comparison to the benchmark driver models. The vehicle *Y*-axis trajectory error using the proposed driver model is significantly reduced, which ensures better handling quality.



(a) (b)

Figure 10: SILS evaluation for DLC maneuver at 80 km/h constant speed: (a) *Y*-axis trajectory; and (b) *Y*-axis trajectory error



(a) (b)

Figure 11: HILS for DLC maneuver at 80 km/h constant speed: (a) *Y*-axis trajectory; and (b) *Y*-axis trajectory error

The automatic steering control is validated using an instrumented automatic steering test rig through the HILS. Figure 11(a) show the proposed driver model controller performance in terms of *Y*-axis trajectory for DLC maneuver. It can be seen that the trends between SILS result and HILS result are almost similar with acceptable error. The small difference in magnitude between SILS and HILS results are due to the fact that, in actual situation, it is indeed very hard for the stepper motor to maintain the perfect angle position of commanded control signal from driver model as compared with the result obtained in the simulation. In terms of *Y*-axis trajectory error response based on the *Y*-axis trajectory of DLC maneuver as shown in Figure 11(b), it can be seen that there are quite good and show that HILS and SILS results are closely matched.

CONCLUSIONS

A yaw effect outer-loop control driver model for automatic steering control on double lane change (DLC) maneuver have been evaluated and validated at 80 km/h constant speed. The proposed driver model which includes adaptive fuzzy logic control is able to adapt within predefined reference path of DLC maneuver tests by using back-propagation algorithm for online parameters tuning. Some of the behaviors of the driver model observed in this work are *Y*-axis trajectory and *Y*-axis trajectory error responses. The performance characteristic of the proposed driver model were evaluated and compared with the benchmark driver models. The SILS results have shown that the proposed driver model is effective in reducing the *Y*-axis trajectory error during DLC maneuvering as compared with benchmark driver models. The proposed inner-loop SMAS system which includes the closed-loop positioning control was developed. SILS results have shown the effectiveness of using yaw effect adaptive fuzzy logic control and proportional gain control in outer-loop control scheme and inner-loop control scheme, respectively. The HILS results have shown that the use of the proposed yaw effect outer-loop control technique prove to be effective in controlling the *Y*-axis trajectory and *Y*-axis trajectory error. SILS results were validated as shown by the experiment HILS results that closely followed SILS results.

REFERENCES

1. Ackermann, J., Guldner, J., Sienel, W., Steinhauser, R., and Utkin, V. I., 1995. Linear and Nonlinear Controller Design for Robust Automatic Steering. *IEEE Transactions on Control Systems Technology*, Vol. 3(1), pp. 132-143.

[2] Wang, L. X., (1994). *Adaptive Fuzzy Systems and Control- Design and Stability Analysis*. Englewood Cliffs, NJ: PTR Prentice Hall, 1994.

[3] Milliken, W. F., and Milliken, D. L., 1995. Race Car Vehicle Dynamics. *Warrendale: SAE Society Automotive Engineers*, R-146.

[4] Wenzel, T. A., Burnham, K. J., Williams, R. A., and Blundell, M. V., 2005. Closed-loop Driver/Vehicle Model for Automotive Control. *System Engineering, 2005. ICSEng 2005. 18th International Conference,* 16-18 Aug. 2005, pp. 46-51.

[5] McRuer, D., and Krendel, E. 1974. Mathematical Models of Human Pilot Behavior. AGARD graph 188, *NATO Advisory Group for Aerospace Research and Development*, London, UK.

[6] Ragazzini, J., 1948. Engineering Aspect of the Human Being as a Servo-Mechanism. *Meeting of the American Psychological Association,* Boston, Sept. 1948.

[7] Morar, A., 2003. Stepper Motor Model for Dynamic Simulation. *Acta Electrotehnica,* Vol. 44(2), pp. 117-122.

[8] Hanzaki, A., Saha, S. and Rao, P. 2005. Analysis of a Six-Bar Rack-and-Pinion Steering Linkage. *SAE Paper*, 2005-26-316.

[9] Schuette, H., and Waeltermann, P. 2005. Hardware-in-the-Loop Testing of Vehicle Dynamics Controllers - A Technical Survey. *SAE Paper*, 2005-01-1660.

[10] Seungkyu, O., Hyoungsoo, K. and Jinhee, J. 2009. Proposals for Improvement of AFS System Using HIL and SIL Simulation, *ICROS-SICE International Joint Conference 2009,* August 18-21, 2009, Fukuoka International Congress Center, Japan, pp. 555-559.

Microchip Surface Printing Visual Inspection System using Blob Analysis Technique

Abu Ubaidah Abdul Aziz, Zamberi Jamaludin and Ahmad Yusairi Bani Hashim
Faculty of Manufacturing Engineering, Universiti Teknikal Malaysia Melaka,
Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia
Phone: +606-3316434, Fax: +606-3316431
ubaidah18@yahoo.com, zamberi@utem.edu.my, yusairi@utem.edu.my

Abstract
This research aims at designing a microchip surface printing visual inspection system for product quality control. The vision control image processing system applies surface printing identification based on the blob analysis technique. The vision based quality control is intended to be robust and intelligent for inspections of surface printing quality on the production of microchips. Blob analysis technique is used in order to speed up the image processing capacity of the system. The system developed is flexible because of the speed improvement in its inspection system.

Keywords
microchip surface printing inspection, visual inspection system, quality control.

INTRODUCTION

Nowadays, machine vision systems are widely used in industry for the purpose of inspection, measurement and recognition process [1]. Figure 1 shows some examples of its application in industry. It has a cost-benefit advantage by replacing human labor and reducing manual errors and production cost due to defects and product rejections [2][3]. Machine vision systems have seen great advances in recent years. For example, Rosenfeld [4] has compiles and reported that nearly 1700 references to computer vision, image processing and analysis have been made in year 1999 alone.

(a) (b)

Figure 1. (a) Differentiation of tires; (b) Detecting groove defect in piston head

In manufacturing of microchips, the large quantity size of its production has made human inspection of its components tedious, time consuming and inconsistent. This is especially true for quality inspection in the area of surface printing identification.

Hence, machine vision system design for microchip surface printing inspection becomes necessary and highly desired. A vision system normally consists of five components. Table 1 identifies these components and their respective functions.

Table 1. Vision system's components and functions

Components	Functions
Radiation resource	Radiation is emitted from the objects so that the objects can be observed.
Camera	To collects radiation received from the object.
Sensor	To converts received radioactive flux into a suitable signal for further processing.
Processing unit	It processes the incoming, generally higher-dimensional data, extracting suitable featured that can be used to measure object properties and categorize them into classes.
Actors	React to the result of the visual observation.

With respect to surface defect inspection and analysis, particularly for surface printing identification, an effective high performance vision inspections system of the following criteria is desired:

i. Fast processing speed
ii. Computationally inexpensive
iii. Employs simple algorithm
iv. Rotational and scale invariant
v. High noise insulation

Presently, various camera-based visions system are commercially available that are capable of quickly and consistently performed measurement of various features of a components. Examples of these are the IMAQ Vision of National Instruments, Matrox Imaging Library and etc. These software platforms have the advantage of offering a variety of image acquisition and processing tools. However, these systems are expensive and offer no unique solution, especially for surface printing detection on microchips. In addition, most of these systems are inherently inflexible. Variations in manufacturing process, product specifications and profiles, and customer demands will

reduce their effectiveness and could disrupt the overall quality of the final product.

Celeb-Solly and Smith [5] have introduces an adaptive surface inspection algorithm using adaptive interactive evolution technique. This methodology enables determination of parameters that control segmentation of surface defects on images. Here, the Region of Interest (ROI) are adapted instead of the traditional classification engine enabling non-image processing expert to interact with the proposed algorithm to produce sot of defect segmentation parameters capable of segmenting ROI to existing system constrains and adapt the algorithm at real-time for the purpose of refocusing the objective of the segmentation, if necessary.

In addition to being adaptive, the speed of the image processing is also important to improve productivity and efficiency. Pattern-matching technique is often applied in surface inspection systems. It locates regions of grayscale image in a matching process with predetermined template. This technique has the advantage such that it is able to template matches even in poor lighting condition, image blur, noise and inconsistent orientation of the template [6]. However, this technique has been found to be time-consuming since it requires excessive computation time. Instead, Mir-Nasiri and Salami [7] have suggested blob analysis technique [8] as an alternative for improvement in the speed of the image processing process. Blob analysis uses a binary image concept in which pixels that are in the background have a zero value while every non-zero pixel becomes part of binary objects. Mir-Nasiri and Salami have also indicated that blob analysis technique can be applied to microchips that are of different sizes and orientations, making it the best suited technique for adaptive and robust application.

This project applies the Mir-Nasiri and Salami concept that is based on blob analysis technique for inspection of the microchip's surface printing quality. This technique posses several advantages such as improving image processing time, reducing time consumed for computational applications, finding different statistical information such as location and presence of printed area, and can be applied to chips of different sizes and orientation.

Omron F-500 vision system is used in this project. The F-500 vision system allows high-precision inspection and measurement. It has a 1-million pixel digital interface that produce clear image and greatly reducing noise in high-resolution video signal. F-500 also has large on-board image and measurement data storage which can store a maximum of 200 images. The A167CA microchip samples are selected as examples for the validation together with a L293D motor driver from STMicroelectronics. The L293D compares both grayscale histograms. Different microchip characteristics will produce different intensity and frequency readings. In other word, the vision system can be used to inspect many types of microchip in the production line.

METHODOLOGY

Figure 2 shows a reconfigurable surface inspection system where the adaptive behavior of the visual inspection system is designed. The first step is image acquisition, where images and video are acquired directly from compatible imaging hardware into the PC. Then, an image pre-processing method is applied to increase the accuracy of detection. The image is segmented into parts that have strong correlation segmentation with objects or areas of the real world contained in an image. If the segmentation process is unsuccessful, this process will be repeated for new segmentation parameters. If the requirements of the segmentation process are met, the features will be extracted for dimensionality reduction. Lastly, the region of interest (ROI) is classified, that is portion of an image that needs to be filtered or to be subjected to some other operations.

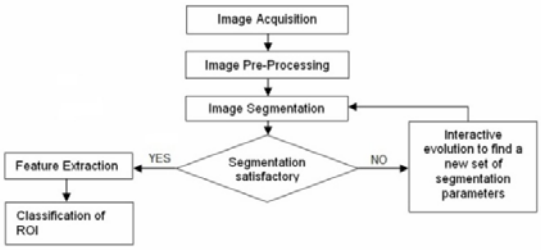


Figure 2. A reconfigurable surface inspection system

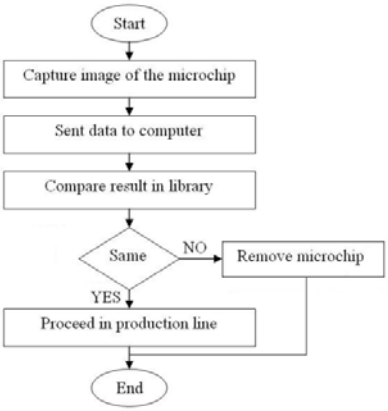


Figure 3. Vision system process

Figure 3 shows a flow chart for the vision system process. First, image of the microchip is captured and the data is sent to the library of the computer. Then, the data is compared with the microchip that does not have any defect (controlled item). If the captured image match image in this library, the microchip will proceed for further processes within the production line. However, if the captured image does not match the

image in the library, the microchip will be removed from the production line.

RESULT AND ANALYSIS

The vision system is used to capture and compare data accurately and to detect surface printing on microchip surface structure efficiently and effectively. The technique that is applied is based on the comparison among different grayscale histogram of each sample in order to identify defected sample in production line. The blob analysis is used in the system to speed up the image processing process. The image of the sample is focused only on the surface of the microchip that consists of the printed area. The region of interest (ROI) is used so that only the printed area appeared inside the ROI that has been defined. The leads quality of the sample is not included for the inspection process. The image data is converted from the color image that consists of red, green and blue channels to binary image in order to display the histogram graph. The comparison between controlled sample (see Figure 4) and other samples are performed based on the variable defect levels; namely, their darkness and intensity levels. Five (5) different samples of microchips with varying printed defect levels are considered in order to demonstrate this proposed technique.

i) Sample A

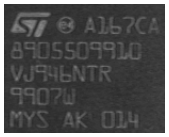


Figure 4. Sample A

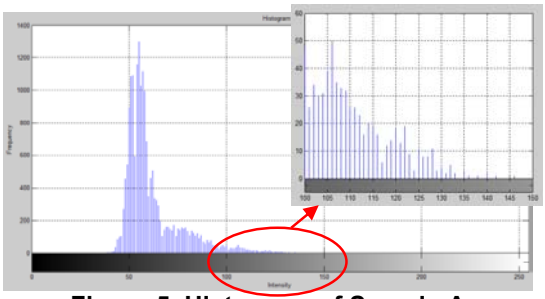


Figure 5. Histogram of Sample A

This sample is considered as the experiment controlled sample. The histogram (Figure 5) shows that sample A has a significant frequency component for intensity levels between 100 and 150. This range is the highest among the four different samples (of similar chip). The peak is identified at ≈1300, which is lowest among all the other samples. The peak indicates the black region of the sample. As conclusion, the black region (microchip surface) for this sample is the lowest and the white region (words) is the highest.

ii) Sample B

Figure 6. Sample B

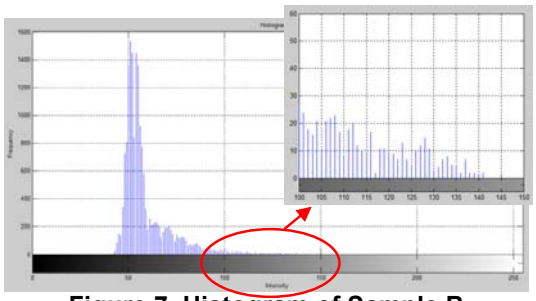


Figure 7. Histogram of Sample B

From Figure 7, sample B has lower average of frequency component compared to the controlled sample A for similar intensity range between 100 and 150 readings. The peak is approximate at ≈1500-1550, which is higher than sample A. There is more black region and less white region compared to sample A. This sample is classified as a reject because the histogram of sample B (Figure 7) did not match with the histogram of sample A (Figure 5).

iii) Sample C

Figure 8. Sample C

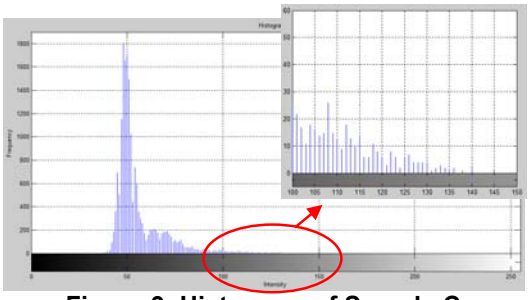


Figure 9. Histogram of Sample C

The histogram in Figure 9 indicates that sample C has a lower average of frequency component reading compared to sample B for intensity level between 100 and 150. The peak of this histogram is determined to be at ≈1800-1820, which is higher than sample B. This means that some words are not clearly visible on this sample compared to the controlled sample A. This sample is also classified as a reject item.

iv) Sample D

Figure 10. Sample D

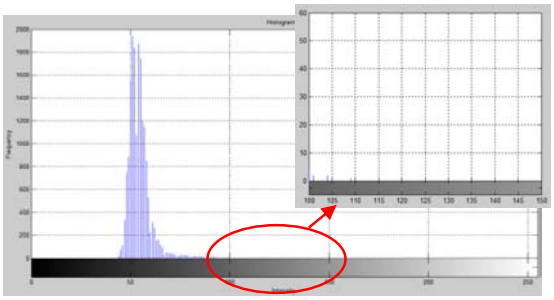


Figure 11. Histogram of Sample D

Sample D (see Figure 11) has the lowest average of frequency component among all the samples for intensity level of 100-150. The peak for sample D is the highest that is between ≈1900-1950. The black region of this sample is the highest and white region is the lowest, which meant that more words are not clearly identified on the sample. This sample is classified as the most defected sample.

v) Sample MD

Figure 12. Sample MD

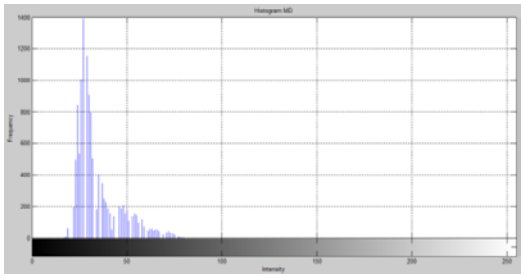


Figure 13. Histogram of Sample MD

Sample MD has a different histogram than the other samples. It means that sample MD is a different sample than sample A, B, C and D. The frequency and the intensity for this sample is different, which means that the black region and the white region are of different characteristics than that of sample A, B, C and D. This sample is used as a comparison sample.

SUMMARY

This paper has demonstrates the ability of applying a vision system for surface printed quality inspection control in production of microchips. The varying amplitude distribution of the frequency component of the sampled within the intensity level of between 100 and 150 can be applied as a basis in categorizing a sample as an acceptable item or as a rejected item. A further analysis is desired in order to generate a good and reliable database system for the design of an automated visual inspection system specializing in the quality of the printed image on the surface of the microchips. In conclusion, the generated algorithm will make it possible for the vision system to quantified different quality properties of a microchip quality based on its shape, darkness and intensity.

ACKNOWLEDGEMENT

The authors would like to acknowledge the technical support and the financial contribution from the Universiti Teknikal Malaysia Melaka (UTeM).

REFERENCES

[1] P. I. Corke. "Visual Control of Robots: High-performance Visual Servoing", Exeter, Great Britain: Research Studies Press Ltd., (1996).

[2] J. Garciamartin, J. Gomez Gil., "Calibration and Evaluation of a Machine Vision Algorithm to Detect Agricultural Tractor Movement", *Bulgarian Journal of Agricultural Science*, 14 (4), 436-444, (2008).

[3] Shih-Jer Huang, Shian-Shin Wu, "Vision-Based Motion Control for Non-autonomous Environment", *Journal Intelligent Robot System*, 54:733-754, (2009).

[4] A. Rosenfeld, "Image Analysis and Computer Vision: 1999 survey", *Computer Visual Image Understanding*, 78, pp. 222-302, (2000).

[5] P. Caleb-Solly, J.E., "Smith, Image and Vision Computing", 25, pp.1058-1072, (2007).

[6] H. Tung-Hsu, "Automated Vision System for IC Lead Inspection", *International Journal of Production Research*, vol. 39, No. 15, (2001).

[7] N. Mir-Naziri, M.J.E. Salami, "An Effective Technique for Visual Inspection of Microchip Leads", CARs & FOF, (2003).

[8] C.A. Hobson, K.I. Hamzah, N.M. Arsad, S.K.S. Abdullah, "Automatic Transistor Lead Inspection", *IEEE International Conference on Image Processing and Its Applications*, No. 410, (1995).

The Effect of Symmetric Matrices Properties to LP Problem in Duality

Adi, S.[1]*, Muzalna, M.J.[2]**, and Ikhsan, R.[3,]***
[1, 2, 3] Faculty of Manufacturing Engineering,
Universiti Teknikal Malaysia Melaka, Durian Tunggal, 76109 Melaka, Malaysia
Phone: +606-3316002, Fax: +606-3316411,
*adi@utem.edu.my, **muzalna@utem.edu.my, ***ahsanuamal@yahoo.com

Abstract
The desire to solve a problem in an optimal way is a common thing in any subjects. Optimization problem usually involved mathematical model. One of the applications has been widely used is Linear Programming. Linear functions applications are frequently used in production planning, networks, scheduling, and other application of a linear function subject to linear constraints. This research is focused on an interpretation in the effect of different characteristics of randomly symmetric matrices to LP problems in Duality. This will provide new findings which may contribute to advancement of LP theory and practice, particularly on the effects of various number of variables and different characteristics of matrices in LP problems to duality.

Keywords
Characteristic matrix, symmetric matrix, duality, linear programming.

INTRODUCTION

A certain group of optimization problems that the objective functions is a linear function of the proposed variables and also the linear equations or inequalities to be called linear programming [1]. Associated with every LP problem, called the primal, there is other linear programming problem called its dual that can be formulated by slightly altering the form of the primal problem. It can be applied to get the originally program solution and also the exceedingly advantageous knowledge of the optimal solution to the primal shall be given by its variable [2].

The researchers have worked through the improvement of LP duality (primal-dual solution), i.e. the evidence of properties of duality relationships had been proved utilized by Corley [3], weak and strong duality in infinite dimensional [4]. Theory in linear programming concerns the concept of duality. The dual solutions can be used to measure the primal sensitivity with respect to changes in the independent term of the restrictions [5].

In linear programming, the primal and dual problem formulations solved by the simultaneous solution. The primal-dual solution will be optimal in the transaction if either the primal or dual problems converge to the same solution, e.g., if the sales revenue of the producer is maximized by primal formulation, then the purchasing cost of the customer is minimized by the related dual formulation [6].

The square matrix termed basis has long played a fundamental role in simplex algorithms for solving LP problems, yet the basis was extended recently to include a deficient case by exploiting primal degeneracy [7]. The symmetric matrices can be classified into five based on different characters of quadratic form i.e. positive definite, positive semi-definite, negative definite, negative semi-definite, and indefinite [8]. Each of the character has its own properties in terms of its determinant.

Commonly, there are two methods that are frequently improved by researcher in LP problem: Simplex Method discovered by George Dantzig, Interior Point Method discovered by Kamarkar. Recently, the judgment of Todd [9] is that the effectiveness of excellent performances of simplex methods and interior point methods are alike for the practiced applications of linear programming. Nevertheless, for particular types of LP problems, it may be that one type of method is better than another type. Simplex method is usually used in small problem properly within admit of measure of dimensions of the order 50 by 100, whereas interior point method is more efficient for some large-scale problem.

Because of this research will be conducted for simulation of matrices in duality come up to dimensions of the order 50 by 50, so it is needed to using simplex method. This research is focused on estimation in the effect of different characteristics of symmetric matrices to linear programming problems in duality. The goal of this research work is to develop duality theory in linear programming for various characteristics matrices.

PROPOSED METHODOLOGY

This paper presents a study on the simulation of optimization linear model for appraising various characteristics of definite matrices. For the purpose of this work, the simplex method will be used in this linear optimization. The steps of the proposed simulation can be summarized as follows:

Step 1. Generate the Random Symmetric Matrices
Symmetric matrices are randomly generated in five types of matrices, ie., Positive Definite (PD), Positive Semi-definite (PSD), Negative Definite (ND), Negative Semi-definite (NSD), In-definite (ID). Matlab will be used to generate random matrix linear programming problem for different characteristics of matrices and different size of matrices.

Step 2. Verify the Properties of Matrices
Setting of simulation design is performed to test the symmetric matrices in exact accord with number of decision variables that followed by five characters set matrices differently in linear programming problem. This step uses the determinant of the leading principal minor of the sub-matrix to verify whether it has included to one of five types.

Step 3. Solve the Subject in LP Problem
The matrices are confirmed, seeking for solution of primal problem. The primal problem is need converted to find the dual problem in a way that is coefficient matrix, the objective function of the primal problem will be done transposing. Meanwhile, once the matrices for dual problem are confirmed, looking for solution of dual problem. A nearly symmetric relation between a primal problem and its dual problem can be seen by considering the following canonical form of linear inequalities:

Primal Problem

$$\text{Max} \quad c_1x_1 + c_2x_2 \ldots\ldots\ldots\ldots c_nx_n = f \qquad (1)$$

$$\text{Subject to :} \quad \left.\begin{array}{l} a_{11}x_1 + a_{12}x_2 \ldots\ldots + a_{1n}x_n \le b_1 \\ a_{21}x_1 + a_{22}x_2 \ldots\ldots + a_{2n}x_n \le b_2 \\ \square \\ an_1x_1 + an_2x_2 \ldots\ldots + a_{nn}x_n \le b_n \end{array}\right\} \qquad (2)$$

$$\text{where} \quad x_1, x_2, \ldots, x_n \ge 0 \qquad (3)$$

It can also be written concisely as:

$$\text{Max} \quad c^T x = f \qquad (4)$$

$$\text{Subject to:} \quad \boldsymbol{A}x \le b \qquad (5)$$

where $\boldsymbol{A}$ is a matrix, c and b are vectors. Each elements (a, b, and c) is $\in \boldsymbol{R}$.

Dual Problem

$$\text{Min} \quad b_1y_1 + b_2y_2 \ldots\ldots\ldots\ldots b_ny_n = v \qquad (6)$$

$$\text{Subject to :} \quad \left.\begin{array}{l} a_{11}y_1 + a_{12}y_2 \ldots\ldots + a_{1n}y_n \ge c_1 \\ a_{21}y_1 + a_{22}y_2 \ldots\ldots + a_{2n}y_n \ge c_2 \\ \square \\ a_{\ 1}y_1 + an_2y_2 \ldots\ldots + a_{nn}y_n \ge c_n \end{array}\right\} \qquad (7)$$

$$\text{where} \quad y_1, y_2, \ldots, y_n \ge 0 \qquad (8)$$

It can also be written concisely as:

$$\text{Min} \quad b^{\ T}y = v \qquad (9)$$

$$\text{Subject to:} \quad \boldsymbol{A}^{\boldsymbol{T}}y \ge c \qquad (10)$$

where $\boldsymbol{A}$ is a matrix, c and b are vectors.

Note that $\boldsymbol{A}$ in LP general form is a matrix, but it shall be formed symmetric matrix as in above. Each elements (a, b, and c) is $\in \boldsymbol{R}$.

Step 4. Validating the Primal-Dual Solution
The result of optimization produces either the value of objective function or the decision variable. The calculation of primal problem as well as dual problem is need compared both Matlab and Excel Solver as a validation from the result of LP problem. Hence, the previous step is required recalculation by use of the Excel Solver.

RESULTS & DISCUSSION

The evaluation some computational results which are illustrated the behavior of randomly symmetric matrices on simplex method that generated in duality linear programming problems. The randomly symmetric matrices will be generated in standard form. The following result for simulation of LP problems:

A. Generating Randomly Matrices
The required matrices are generated for adjusting the linear programming formats are all parameters that consist of the coefficient matrix as the coefficient for constraint, the column vector as the right-hand side, and the row vector as the coefficient for objective function. These matrices will be then used to simulate on primal problem as well as dual problem of the linear programming problems.

In particularly, the coefficient matrices are formed in the square matrices that belonging to each one of five various characters of symmetric matrices that include PD, PSD, ND, NSD, ID. Actually, the size of matrices that are simulated in this research just a few orders of matrices (i.e. 5x5, 10x10, 20x20, 30x30, 50x50) whereby are considered to be the representative sample. A small part of result of generated symmetric matrices randomly is shown in the following Table 8.

Table 8. The Size 5x5 of Symmetric Matrices

Type	Generate of the Matrices														
	1st					2nd					3rd				
	30	8	1	6	9	26	4	4	8	8	21	9	3	9	5
PD	8	25	2	9	7	4	30	2	7	0	9	21	2	6	4
	1	2	22	4	10	4	2	21	0	4	3	2	23	1	10
	6	9	4	24	8	8	7	0	28	7	9	6	1	24	8
	9	7	10	8	23	8	0	4	7	27	5	4	10	8	25
	-42	1	2	1	7	-42	4	5	3	5	-42	3	4	3	1
	1	-47	10	4	0	4	-46	4	7	10	3	-48	8	8	1
ND	2	10	-40	9	8	5	4	-44	7	3	4	8	-44	8	5
	1	4	9	-42	9	3	7	7	-48	6	3	8	8	-46	8
	7	0	8	9	-43	5	10	3	6	-48	1	1	5	8	-41
	70	21	24	31	31	62	17	16	28	28	57	15	10	24	24
	21	62	14	19	19	17	62	18	26	26	15	69	13	34	34
PSD	24	14	67	28	28	16	18	65	25	25	10	13	58	22	22
	31	19	28	69	69	28	26	25	81	81	24	34	22	74	74
	31	19	28	69	69	28	26	25	81	81	24	34	22	74	74
	-238	16	15	26	26	-242	17	8	27	27	-238	9	6	25	25
	16	-237	8	23	23	17	-240	8	17	17	9	-243	5	23	23
NSD	15	8	-240	23	23	8	8	-244	16	16	6	5	-247	18	18
	26	23	23	-229	-229	27	17	16	-230	-230	25	23	18	-220	-220
	26	23	23	-229	-229	27	17	16	-230	-230	25	23	18	-220	-220
	-4	12	-2	1	3	9	-4	7	-16	5	-10	-6	0	9	6
	12	12	7	11	-13	-4	7	12	3	2	-6	4	-3	7	-3
ID	-2	7	-6	1	7	7	12	-12	-11	-9	0	-3	11	6	-4
	1	11	1	-1	16	-16	3	-11	14	-22	9	7	6	0	-3
	3	-13	7	16	-7	5	2	-9	-22	-1	6	-3	-4	-3	-15

B. Verifying the Properties of Matrices
A kinds of the matrices that are needs be verified in term of properties of matrices are only the symmetric

matrices which have been generated randomly by Matlab software. The verification that is conducted of these matrices use the determinant of the leading principal minor of the sub-matrix. This procedure is well-known as Sylvester's Theorem.

Let α_k be the determinant of the leading principal sub-matrix of order k of A, i.e.

$\alpha_1 = a_{11}$, $\alpha_2 = det \begin{bmatrix} a_{11} & a_{12} \\ a_{12} & a_{22} \end{bmatrix}$,

$\alpha_3 = det \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{12} & a_{22} & a_{23} \\ a_{13} & a_{23} & a_{33} \end{bmatrix}$, . . . , $\alpha_n = det\ A$

Then, the conditional statement met the criteria of symmetric matrix A is described in Table 9 as follow:

Table 9. The conditional statement of symmetric matrix

Type	Relation	Condition
PD	<=>	$ak > 0$ for all k
ND	<=>	$ak < 0$ for odd k & $ak > 0$ for even k
PSD	<=>	$an = 0$ & all k are ≥ 0
NSD	<=>	$an = 0$ & odd k are ≤ 0 and even k are ≥ 0
ID	=>	diagonal elements have different signs or some even k are < 0

Now, each a result of the generated matrices is done testing to verify and ensure that those are included in one of five types within the symmetric matrices. For example, it is one of result the generated symmetric matrices will be taken to verify with adopting the right way of programming logic above mentioned shown as follows.

$$A = \begin{bmatrix} 30 & 8 & 1 & 6 & 9 \\ 8 & 25 & 2 & 9 & 7 \\ 1 & 2 & 22 & 4 & 10 \\ 6 & 9 & 4 & 24 & 8 \\ 9 & 7 & 10 & 8 & 23 \end{bmatrix}$$

For the matrix A, there are five principal minors namely of order 1 until order 5, the following answer of each of principal minors for detail:

$\alpha_1 = 30$, $\alpha_2 = det \begin{bmatrix} 30 & 8 \\ 8 & 25 \end{bmatrix} = 686$,

$\alpha_3 = det \begin{bmatrix} 30 & 8 & 1 \\ 8 & 25 & 2 \\ 1 & 2 & 22 \end{bmatrix} = 14979$,

$\alpha_4 = det \begin{bmatrix} 30 & 8 & 1 & 6 \\ 8 & 25 & 2 & 9 \\ 1 & 2 & 22 & 4 \\ 6 & 9 & 4 & 24 \end{bmatrix} = 298453$,

$\alpha_5 = det \begin{bmatrix} 30 & 8 & 1 & 6 & 9 \\ 8 & 25 & 2 & 9 & 7 \\ 1 & 2 & 22 & 4 & 10 \\ 6 & 9 & 4 & 24 & 8 \\ 9 & 7 & 10 & 8 & 23 \end{bmatrix} = 4421637$.

It is appear which these results of all principal minors are greater than zero (non-negative). Thus, it is clearly answered that the matrix A has been verified as a PD symmetric matrix.

C. Solving the Subject in Primal Problem

Every one of LP problems always comprises of a symmetric matrix, and two vectors that will be used to simulate on both primal problem and dual problem of the linear programming problems. In primal problem, the simulation of are performed using Matlab software. For example of simulation result is provided as follows.

$$A = \begin{bmatrix} 30 & 8 & 1 & 6 & 9 \\ 8 & 25 & 2 & 9 & 7 \\ 1 & 2 & 22 & 4 & 10 \\ 6 & 9 & 4 & 24 & 8 \\ 9 & 7 & 10 & 8 & 23 \end{bmatrix},\ b = \begin{bmatrix} 41 \\ 60 \\ 75 \\ 58 \\ 55 \end{bmatrix},$$

$$c^T = \begin{bmatrix} 66 & 24 & 30 & 68 & 53 \end{bmatrix}$$

The formula of Primal Problem is:

Max $c^T x = f$

Subject to: $Ax \leq b$

where $x_1, x_2, \ldots, x_n \geq 0$

So that,

Max $\begin{bmatrix} 66 & 24 & 30 & 68 & 53 \end{bmatrix} * \begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ X_4 \\ X_5 \end{bmatrix}$

Subject to $\begin{bmatrix} 30 & 8 & 1 & 6 & 9 \\ 8 & 25 & 2 & 9 & 7 \\ 1 & 2 & 22 & 4 & 10 \\ 6 & 9 & 4 & 24 & 8 \\ 9 & 7 & 10 & 8 & 23 \end{bmatrix} * \begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ X_4 \\ X_5 \end{bmatrix}$

$\leq \begin{bmatrix} 41 \\ 60 \\ 75 \\ 58 \\ 55 \end{bmatrix}$, where $\begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ X_4 \\ X_5 \end{bmatrix} \geq 0$

The result of the objective function value (f) is 268.9187, and shown that it has converged in an optimal solution.

The result of the decision variables value is

$x_1 = 0.88725$, $x_2 = 0$, $x_3 = 2.992081$, $x_4 = 1.638394$, $x_5 = 0.173338$.

In this research, the above procedures are conducted in each of five its characteristics as many thirty (30) times with different set of variables i.e. 5, 10, 20, 30 and 50 variables. These are based on the matrices and vector that have randomly generated the different matrices elements.

D. Converting the Matrices to Dual Problem

The primal problem is required conversion to find the dual problem in a way that is the coefficient matrix, the column vector, and the row vector of the primal problem will be done transposing. Especially, since the coefficient matrix has symmetric-shaped so it will be congruent although having taken transposition. On the other hand, the column vector will be interchange the row and column turning into the row vector, and vice versa. It can be shown as follows.

$$A^T = \begin{bmatrix} 30 & 8 & 1 & 6 & 9 \\ 8 & 25 & 2 & 9 & 7 \\ 1 & 2 & 22 & 4 & 10 \\ 6 & 9 & 4 & 24 & 8 \\ 9 & 7 & 10 & 8 & 23 \end{bmatrix}, \quad c = \begin{bmatrix} 66 \\ 24 \\ 30 \\ 68 \\ 53 \end{bmatrix},$$

$$b^T = [41 \quad 60 \quad 75 \quad 58 \quad 55]$$

E. Solving the Subject in Dual Problem

The formula of Dual Problem is:

Min $b^T y = v$

Subject to: $A^T y \geq c$

where $y_1, y_2, \ldots, y_n \geq 0$

So that,

Min $[41 \quad 60 \quad 75 \quad 58 \quad 55] * \begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \\ Y_4 \\ Y_5 \end{bmatrix}$

Subject to $\begin{bmatrix} 30 & 8 & 1 & 6 & 9 \\ 8 & 25 & 2 & 9 & 7 \\ 1 & 2 & 22 & 4 & 10 \\ 6 & 9 & 4 & 24 & 8 \\ 9 & 7 & 10 & 8 & 23 \end{bmatrix} * \begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \\ Y_4 \\ Y_5 \end{bmatrix} \geq \begin{bmatrix} 66 \\ 24 \\ 30 \\ 68 \\ 53 \end{bmatrix}$, where $\begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \\ Y_4 \\ Y_5 \end{bmatrix} \geq 0$

The result of the objective function value (v) is 268.9187, and shown that it has converged in an optimal solution.

The result of the decision variables value is $y_1 = 1.544933$, $y_2 = 0$, $y_3 = 0.586596$, $y_4 = 2.112695$, $y_5 = 0.709916$.

In this research, the steps in above are also conducted in Matlab Software as many thirty times repetitively with produce the matrices and vector that have the different matrices elements randomly.

F. Validating the Primal-Dual Solution

The result of optimization produces either the value of objective function or the decision variable. The calculation of primal problem as well as dual problem is need compared both Matlab and Excel Solver as a validation from the result of LP problem. Hence, the previous step is required recalculation by use of the Excel Solver. The results of calculation on Excel solver are shown that both objective function values in primal solutions are 268.9187 as viewed in **Error! Reference source not found.** and also dual solution as shown in **Error! Reference source not found.**. It seen that those values are similar precisely among primal and dual solution and then the Excel solver have found the optimal solution from the two of them.

G. Sensitivity Analysis

To determine how sensitive the optimal solution in term of change in data value is necessitated sensitivity analysis. This includes either analyzing changes in a Right-Hand Side (RHS) or an Objective Function Coefficient (OFC). It can be appeared in **Error! Reference source not found.** and also **Error! Reference source not found.** that in the Constraints section, if Final Value = Constraint RHS, then slack should be zero, and because the resource is in a little supply, it should have a non-zero Shadow Price. On the other hand, slack must be positive, and Shadow Price must be zero, if Final Value ≠ Constraint RHS. The Allowable Increase as well as the Decrease will illustrate Unlimited (1E+30) depending on which direction is not significant (where slack/surplus keeps growing).

H. Comparison of the Whole Experiment Result

The overall simulation results are compared among primal and dual solution in different setting of Linear Programming Problems and those are given in **Error! Reference source not found.**.

And then, the result of primal and dual solution is evaluated either the theory of duality in linear programming problem or the theory of matrix in linear algebra.

It can be seen from **Error! Reference source not found.** that the relations of the computerized experimental result showing PD, ND, and some ID have equal in values between the primal objective value and the dual objective value lead to achieve optimal solution. Meanwhile, PSD, NSD, and another ID are different values between the primal objective value and the dual objective value or duality gap, in these conditions arising three (3) possibilities any one of optimal, unbounded and infeasible.

CONCLUSIONS

1) The Computerized experiment results appear that the objective function values of both primal and dual solution are exactly same with comparison using Matlab as well as Excel Solver**.**
2) Between the primal objective value and the dual objective value are same value or achieve optimal solution owned by PD, ND, and some ID
3) There are difference between the primal objective value and the dual objective value or duality gap in PSD, NSD, and another ID.
4) The Symmetric matrices have been proven that almost of those is non-singular overarching PD, PSD, ID. On the other hand, another are singular i.e. ND, NSD.

ACKNOWLEDGMENTS

The authors would like to thank The Ministry of Higher Education Malaysia for the financial support under Fundamental Research Grant Scheme and Department Manufacturing Management, Faculty of Manufacturing

Engineering, Universiti Teknikal Malaysia Melaka (UTeM) for support and providing facilities.

REFERENCES

[1] Ravindran, A., Ragsdell, K.M., Reklaitis, G.V., *Engineering Optimization Methods and Applications,* 2nd ed.., John Wiley and Sons, New Jersey, the United States. (2006).

[2] Bazarra, M.S., Jarvis, J.J., *Linear Programming and Network Flows*, John Wiley and Sons, Canada (1977).

[3] Corley, H.W., Duality Theory for the Matrix Linear Programming Problem. *Journal of Mathematical Analysis and Applications*, 104(1) (1983) 47-52.

[4] Romeijn, H.E., Smith, R.L., & Bean, J.C. Duality in Infinite Dimensional Linear Programming. *Mathematical Programming*, 53 (1992) 79-97.

[5] Balbas, A., Jimenez, P., & Heras, A. Duality Theory and slackness Conditions in Multiobjective Linear Programming. *An International Journal Computers & Mathematics with Applications,* 37 (1999) 101-109.

[6] Scherpereel, C.M. Alignment: the duality of decision problems. Management Decision, 44(9) (2006) 1258-1276.

[7] Pan, P.-Q. A Revised Dual Projective Pivot Algorithm For Linear Programming. *SIAM Journal Optimization,* 16(1) (2005) 49-68.

[8] Laub, A.J. *Matrix Analysis for Scientists and Engineers*. The United States of America: Society for Industrial and Applied Mathematics. (2005).

[9] Todd, M.J. The Many Facets of linear programming. *Mathematical Programming*, 91 (2002) 417-436.

Shear Behaviour of Mining Sand Containing Plastic and Nonplastic Fines

Thian, S.Y. and C.Y. Lee
Department of Civil Engineering, College of Engineering
Universiti Tenaga Nasional, Malaysia
siawyin_thian@yahoo.com

Abstract
In this paper, sand specimens containing fines are performed in undrained triaxial compression tests. The objective of this paper is to study the behaviour of sand having 10%, 20% and 30% and 40% of plastic fines (kaolin clay) or nonplastic fines (silt). Comparisons between mining sand containing nonplastic and plastic fines are made. Sand containing nonplastic fines usually has a greater tendency to dilate than sand containing plastic fines. However, as the content of nonplastic fines increases in soil specimens (20% or more), the dilative behaviour reduces.

INTRODUCTION

Although there were many researches done on clean sand [1, 2, 3], many natural and man-made soil deposits are neither clean sands, pure clays nor pure silt, but rather a combination of these materials (plus gravel) in various proportions. Information on these materials' mechanical properties is necessary if realistic analyses are to be done on geotechnical problems involving these materials. The characteristics of shear strength may be affected by the inclusion of fines in granular soils.

Studies done on silty sand indicate that sandy silt is more difficult to characterize than the behaviour of clay because of their tendency to dilate during shearing [4]. Sandy silt tends to decrease in pore water pressure and dilate due to increasing strains as the specimens are sheared [5].

EXPERIMENTAL PROGRAMME

Soil Constituents Selected

Mining sand was selected as the coarser grain matrix. The finer grain matrix was either plastic or nonplastic fines. Figure 1 shows the grain-size distributions of mining sand, nonplastic silt and plastic kaolin clay used in this study. The mining sand used is angular and has a value of specific gravity of solid particle of about 2.63. Its uniformity coefficient, C_U, and curvature coefficient, C_Z are 2.08 and 1.27, respectively. Hence, it is classified as poorly graded soil. The mining sand has a minimum dry density of 1413kg/m^3 and maximum dry density of 1565 kg/m^3.

The kaolin clay used has a liquid limit of 61%, plastic limit of 34%, plastic index of 27%, specific gravity of 2.69, optimum moisture content of 38%, maximum dry density of 1350 kg/m^3 and is classified as clay with high plasticity (CH) [6]. The silt used in this study is defined as high purity crystalline quartz filler, with specific gravity of 2.65 and pH of 5.6–7.5. The nonplastic silt is composed of SiO_2 (99.8%), with Al_2O_3 (0.05%) and Fe_2O_3 (0.01%) as secondary components.

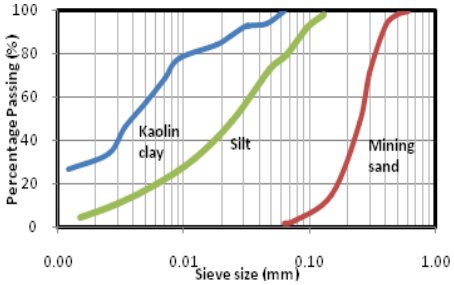


Figure 1. Sieve analysis for mining sand, silt and Kaolin clay

Soil Specimen Preparation and Testing Procedures

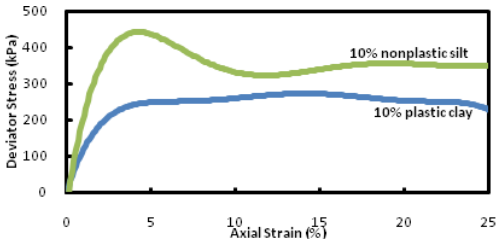
The sand mixtures containing plastic or nonplastic fines were reconstituted in the laboratory by combining oven dried mining sand with either silt or kaolin clay. The mining sand and fines were mixed manually in a dry state thoroughly until the mixtures were observed to be visually homogeneous. The soil specimens were prepared by dry-tamping method, which was performed by compacting the mixture in three equal layers to a required relative density. The diameter and height of every soil specimen were measured to be 50mm and 100mm, respectively. All the specimens were prepared with 10%, 20%, 30% or 40% plastic and nonplastic fines. Saturation of soil specimens was achieved by applying cell and back pressures and full saturation was assumed to have taken place when Skempton's B-parameter was greater than 0.95.

Soil specimens were isotropically consolidated under confining pressures of 100kPa and 200kPa after the saturation stage had completed. The specimens were then sheared under undrained condition (CIU) at the rate of 0.04 mm/minute up to an axial strain of 25%. The testing procedures and data acquisition were performed by using GDSLAB software and GDS Data Acquisition System.

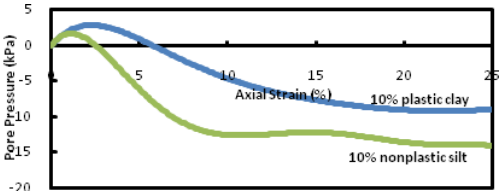
TEST RESULTS

The CIU triaxial tests were performed to investigate the effects of the fines on the stress-strain-excess pore pressure response of mining sand. Figure 2 shows the typical results for medium dense sands containing 10% nonplastic silt and plastic clay tested under confining pressure of 100kPa. Negative excess pore pressure in sand containing 10% nonplastic fines and plastic fines indicates dilation. Sand with nonplastic fines has higher tendency to dilate than that with plastic fines.

Figure 3 shows similar behaviour as the confining pressure increases to 200kPa. When the sand specimen with 10% nonplastic fines is confined at a higher pressure, the soil particles tend to be packed together more densely, causing soil specimen to be more dilative. The nonplastic fines content is actually helping to enhance dilatancy and shear strength of sand when sand particles come in closer contact as shearing takes place. However, when nonplastic silt in soil specimen is replaced with plastic clay, the soil specimen becomes more compressive.

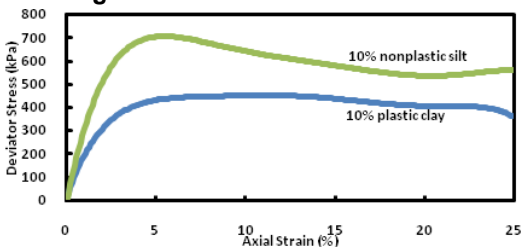


(a) Deviator stress-strain curves

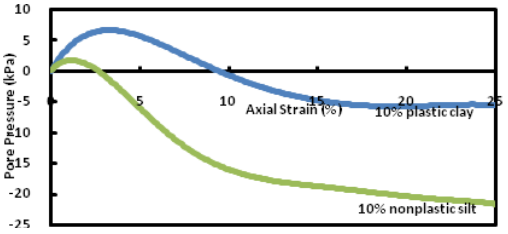


(b) Excess pore pressure versus axial strain

Figure 2. Results of 10% plastic and nonplastic fines in mining sand at 100kPa confining stress



(a) Deviator stress-strain curves

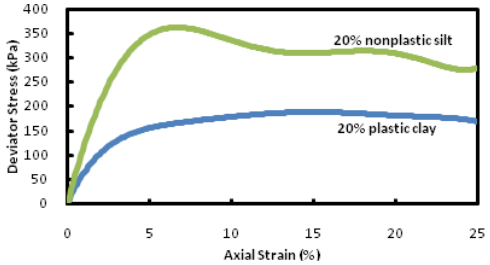


(b) Excess pore pressure versus axial strain

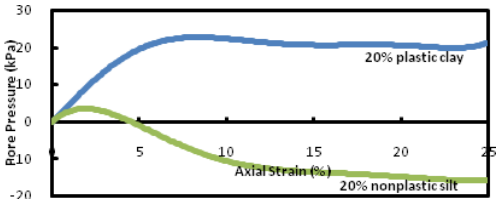
Figure 3. Results of 10% plastic and nonplastic fines in mining sand at 200kPa confining stress

Figure 4 shows that the shear resistance decreases when the fines content increases from 10% to 20%. For low nonplastic fines contents (about 20% or less), the silt particles occupy spaces adjacent to neighbouring sand particles, increasing particle interlocking and thus, the soil becomes more dilative [7]. The presence of nonplastic fines increases soil dilatancy, therefore increasing the soil shear strength and the stresses mobilized at larger strains. However, plastic fines content in sand reduces the particle friction developed at the contacts between sand grains, and decreases the shear strength of the soil and the stresses mobilized at larger strains. Plastic fines content suppressed the dilatant tendency of sand and therefore, the soil becomes less dilative than nonplastic silty sand.

The presence of 20% plastic fines in sand makes the soil more contractive as indicated by the increase of positive excess pore pressure and no longer exhibits any dilation as sand with 10% plastic fines. The clay particles become dominant as the soil behaves in more cohesive manner. The dilatancy response of sand with plastic fines decreases continuously as the plastic fines content increases from 10% to 20%. Figure 5 shows the similar results for 20% fines content in mining sand at 200kPa confining pressure. However, at higher confining pressure, the dilative behaviour of sand with 20% nonplastic fines is less significant comparing with sand with 10% nonplastic fines.

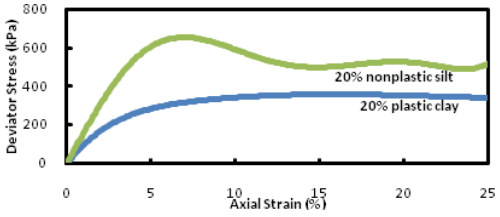


(a) Deviator stress-strain curves

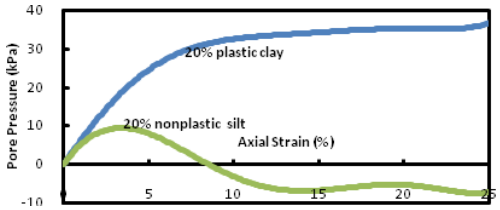


(b) Excess pore pressure versus axial strain

Figure 4. Results of 20% plastic and nonplastic fines in mining sand at 100kPa confining stress



(a) Deviator stress-strain curves



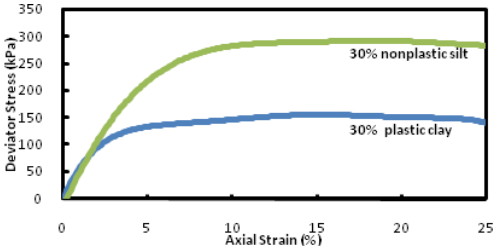
(b) Excess pore pressure versus axial strain

Figure 5. Results of 20% plastic and nonplastic fines in mining sand at 200kPa confining stress

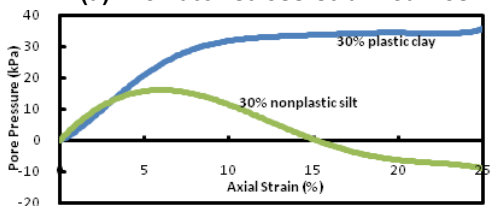
Figure 6 shows the stress-strain-pore pressure curves for 30% fines in mining sand. The mining sand behaves less dilatively as the fines content increases. The mining sand tends to exhibit strain-hardening behaviour when the nonplastic fines content is more than 20%.

Dilatancy is expected to be increasingly suppressed for mining sand with more than 15% nonplastic fines when a primarily floating fabric develops. This is because the fabric gets progressively weaker when the silt particles separate the sand particles from each other more and more. It is found out that at 15% of nonplastic fines content, the fines start to be dominant, and at 20% nonplastic fines content, they begin to take full control of the soil response. Soil fabric becomes more stable and the stiffness is stabilized with increasing nonplastic fines content [7].

Figure 7 shows similar trend of curves when confining stress is increased to 200kPa. As the confining stress increases, the excess pore pressure increases for sand with plastic fines because the pressure built up inside the soil specimen is greater. The sand-skeleton void ratio increases with increasing fines content. For plastic fines content of 30%, the sand-skeleton void ratio of the specimen is significantly larger than the maximum void ratio for the clean sand indicating that the kaolinite fines dominate the soil matrix and the soil responds more like cohesive material [8].

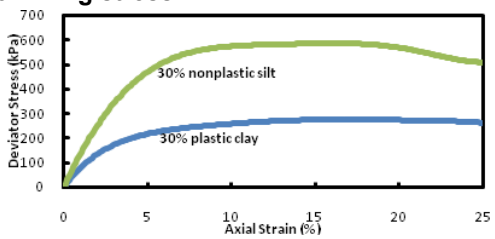


(a) Deviator stress-strain curves

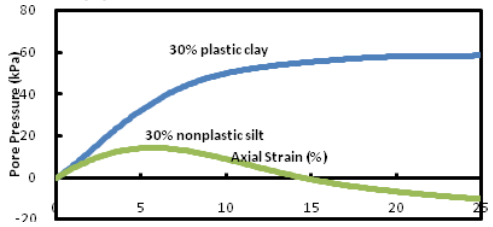


(b) Excess pore pressure versus axial strain

Figure 6. Results of 30% plastic and nonplastic fines in mining sand at 100kPa confining stress



(a) Deviator stress-strain curves

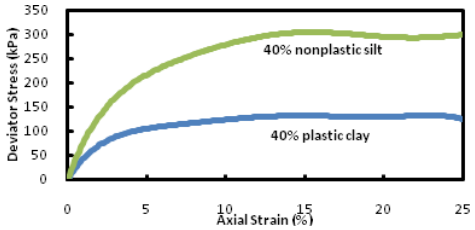


(b) Excess pore pressure versus axial strain

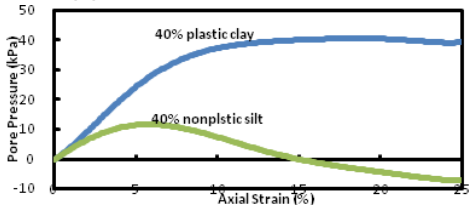
Figure 7. Results of 30% plastic and nonplastic fines in mining sand at 200kPa confining stress

Figures 8 and 9 are the stress-strain-pore pressure curves for mining sand containing 40% fines content under 100kPa and 200kPa confining stresses, respectively. The results again indicate that the shear strength decreases with increasing fines contents. However, it is interesting to note that the mining sand

with 40% fines content yields positive pore pressures due to contractive soil response.

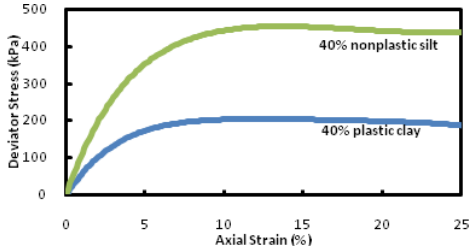


(a) Deviator stress-strain curves

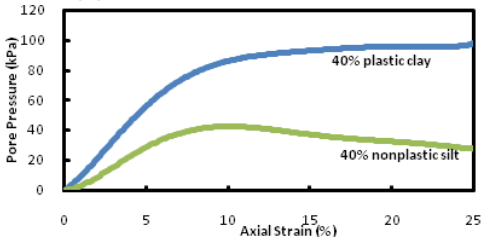


(b) Excess pore pressure versus axial strain

Figure 8. Results of 40% plastic and nonplastic fines in mining sand at 100kPa confining stress



(a) Deviator stress-strain curves

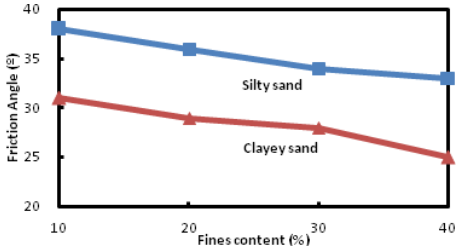


(b) Excess pore pressure versus axial strain

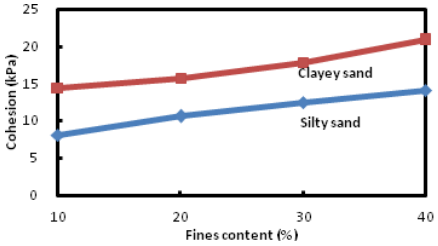
Figure 9. Results of 40% plastic and nonplastic fines in mining sand at 200kPa confining stress

Figure 10 shows the shear strength parameters (friction angle, Φ and cohesion, C) variation with both plastic and nonplastic fines contents. The soil specimen with nonplastic fines results in higher friction angle than that with plastic fines. However, the friction angle of the soil specimen decreases with increasing of both types of fines contents.

As expected, the cohesion of soil specimen with plastic fines is higher than that with nonplastic fines. In general, the cohesion of the soil specimen increases with both types of fines contents.



(a) Soil friction angle



(b) Soil cohesion

Figure 10. Variation of soil friction angle and soil cohesion with fines contents

CONCLUSIONS

From the experimental results obtained in this study, the following conclusions may be made:

1. The mining sand with nonplastic fines yields higher shear resistance than that with plastic fines.
2. The mining sand with 10% plastic fines shows initial contractive behaviour but it becomes dilative behaviour at higher strain indicating that the sand matrix is still dominant in the soil specimen.
3. The mining sand exhibits contractive response when its plastic fines content exceeds 20%.
4. The mining sand exhibits less dilative response when its nonplastic fines content exceeds 20%
5. The friction angle of the soil specimen decreases with both plastic and nonplastic fines contents. However, the cohesion increases with both types of fines contents.

REFERENCES

[1] Bolton, M. D. The strength and dilatancy of sands, Ge'otechnique, London 1986; 36(1), 65–78.

[2] Lo Presti, D. C. F. "Mechanical behaviour of Ticino sand from resonant column tests," PhD thesis, Politecnico di Torino, Turin, Italy (1987).

[3] Lo Presti, D. C. F., Pedroni, S., and Crippa, V. Maximum dry density of cohesionless soil by pluviation and by ASTM D 4253-83: a comparative study. Geotech. Testing J. 1992; 15(2), 180–189.

[4] Yamamuro, J. A. and Kelly, M. C. Monotonic and cyclic liquefaction of very loose sands

with high silt content. J. Geotech. Eng., ASCE 2001; 127(4), 314–324.

[5] Tint, K. S., Kim, Y. S., Seo I.-S., and Kim D.-M. Shear behaviour of overconsolidated Nakdong river sandy silt. KSCE J. Civil Eng. 2007; 11(5), 233–241.

[6] British Standard BS 5930. Code of practice for site investigations (1999).

[7] Salgado, R., Bandini, P., and Karim, A. Shear strength and stiffness of silty sand. J. Geotech. Geoenviron. Eng. ASCE 2000; 126(5), 451 – 462.

[8] M. Derakhshandi., E. M. Rathje, K. Hazirbaba, S. M. Mirhosseini. The effect of plastic fines on the pore pressure generation characteristics of saturated sands. Soil Dynamics and Earthquake Engineering, 28 (2008), 376 – 386.

Temperature Analysis on Bi-fuel Single Cylinder Engine Fueled by Petrol & LPG

I. Meran*, M. S. G. Herawan, Y. Sulaiman and M. R. Ayob
Faculty of Mechanical Engineering, Universiti Teknikal Malaysia Melaka,
Locked Bag 1752, Pejabat Pos Durian Tunggal, Melaka.
Phone: +6013-6241058 *E-mail: is_crosfire85@yahoo.com

Abstract
In this study, characteristics on single piston spark ignition (SI) internal combustion engine (ICE) operated with unleaded petrol (ULP) and liquid petroleum gas (LPG) has been compared. In particular, temperatures were examined using thermocouple and the fuel consumption was examined using precise Pierburg PLU 401 device, while gaseous fuel consumption was registered by a tensometric. The purpose in temperature test is to identify which fuel can contribute damage on engine component. Result show that SI engine fueled by LPG produce more heat compared ULP. Temperature output from engine fuel by LPG and ULP is 510°C and 435°C respectively. However SI engine fueled by LPG require more fuel to reach certain RPM due to the LPG energy content per volume.

Keywords
Single cylinder Engine, temperature, fuel onsumption, LPG, ULP.

INTRODUCTION

Liquefied petroleum gases (LPGs) are by-products of natural gas production and crude oil refineries. It consists of propane or butane or mixtures of both. Propylene and butylenes are usually also present in small concentration. A powerful odorant, ethanethiol is added, so if there is a leak on the container (tank) it can be easily detected. It is generally accepted that the emission form a LPG powered vehicle are less than those from the ULP fuelled equivalent. Result from corroborated by Klausmeier and Billick [4] and Wu et al. [5] Newkirk et al.[6] presented measured data showing that NOx emission from LPG fuels are lower compared to ULP. One such study by Snelgrove et al. [3] state that hydrocarbon (HC) emission were reported as 40% lower, carbon monoxide (CO) as 60% lower and carbon dioxide (CO2) as subtantialy reduced, principally due to high hydrogen/carbon ratio of LPG when compared to ULP. Temperature produce due to the combustion of fuel in internal combustion engines may contribute damage to the engine component. Since the conventional engine was dedicated to run on ULP or diesel still facing problem impact from heat release due to combustion. It is not possible that engine fueled by LPG can contribute damage to the engine component. In the combination with efficient powertrain and engine technologies, the potential of LPG is excellent for comparably light and cost effective in reduction of CO2 and toxic emission in the future. As the LPG fuelling stations are not familiar in Malaysia, so it's far widespread enough to make a dedicated LPG vehicle practical, it results necessary to start with proposing alternatively LPG powered engines. Such a bi-fuel automotive engines are necessary to bridge the gap between ULP and LPG. The important characteristics of LPG on vehicle are, LPG has higher octane number of about 112, means it enables higher compression ratios to be employed and gives more thermal efficiencies. Due to gaseous nature of LPG, smoother acceleration and idling performance is achieved. Fuel consumption is increase as compared to ULP and this is due to the energy content per volume. Power output is reduced in LPG operation as compared to ULP [3]. LPG system on vehicle requires more safety because LPG is the gaseous fuel. LPG engines have good durability and good cold start performance [1-2]. Hence liquefied petroleum gas is a versatile form of energy that can be used for many areas. Unlike other conventional fossil fuels, LPG is not only cleaner but also less harmful to the environment. LPG is not just about cleaner fuel but it also good in performance. One of the technologies that have been develops by Australian LPG Warehouse, where the liquid LPG is injected into behind of intake valve show the improvement in performance of engine fuel by LPG. SI engine fueled by LPG can allow higher compression ratio due to the research octane number (RON) contain on the LPG up to 112 for pure propane. Considering on the engine power output, emission and fuel cost, LPG fuel was expected to have market potential as the alternative fuel for vehicle. As the price of petroleum in the automotive industry continues to rise, converting to LPG is a wise decision. To achieve the optimal performance and maximum environmental benefits of LPG, technological advancements must continue to reduce the costs of dedicated vehicles to be competitive with conventional vehicles.

CONVERSION

The Automotive industry is very slow in reacting to the depleting supply of crude oil which tenders for commercializing of new automotive technology fueled by alternative energy sources. This is unlikely to change in the near future since the industry's objective is not about a greener world but based on supply and demand with profit at its centre. Nobody seems to take the first step to revolutionized the industry. The only feasible change will be a gradual conversion. This is

where LPG is most versatile fuel available. It can be used with existing fuel system (bi-fuel) and fully functional on is own. Almost negligible alteration is required. Currently a number of automotive petrol vehicles have been fitted with LPG system by researchers at the current university. The vehicles are classified as bi-fueled. Results have shown significant cost savings. On road test runs have shown that the vehicle is capable of running on LPG alone without the use of petrol. Such system is necessary to bridge the gap between the current petrol driven vehicles and fully LPG vehicles. Widespread LPG refueling stations need to be constructed to promote its widespread application. Another popular mode of transport is the motorcycle fueled by petrol. It is therefore inherent that the technology is developed and its use be promoted alongside the LPG automotive conversion. This paper introduces initial results of the ongoing study of LPG fueling system for petrol driven engines. This paper presents the experimental test results of one particular engine namely, the Modenas Kriss 111 cc single cylinder engine.

EXPERIMENTAL SETUP

Experiment was carried out on a single cylinder Modenas Kriss. Engine specifications are tabulate on Table 1.

Table 1: Specification of tested engine

Criteria	Description
Type	Four-stroke, spark ignition, single cylinder, SOHC
Displacement	111 cc
Compression ratio	9.3 : 1
Carburetor	KEIHIN PB18
Ignition system	Magneto to CDI
Cooling system	Air cooled
Bore x stroke	53.0 mm x 50.6mm
Spark plug	NGK C6HAS

Figure 19: LPG valve capsule

In this experiment the LPG vaporizer was replace with LPG valve capsule (Figure1) where the function of the vaporizer still exist on this devices but without heating element just like current vaporizer apply. LPG valve capsule also reduce weight and space usage. Ignition spark timing remains same for both mode series. The reason to leave the ignition spark timing remains same for both mode series is because the interest is to analyze the characteristics of the single cylinder engine with standard manufacture setting when fueled by ULP and LPG

Table 2: Thermocouple location attach on engine

Channel	Location
1	Intake air on carburetor
2	Intake manifold
3	Engine block
4	Exhaust
5	Lubricant oil
6	LPG valve capsule inlet
7	LPG valve capsule outlet
8	Ambient

In order to attach thermocouple to the engine, soft abrasive paper (grade: 500) was applied to remove paint, rust, or any particle that prevent thermocouple from directly contact to the surface to be tested. After that apply solvent (turpentine) in order to remove any dirt on the component surface and leave it to dry about 30 minutes. Thermocouple was attached to the specific location (Table 2) with using Silicaflex™ Tape AB by Insulflex. For measuring the lubricant oil temperature, small hole was made to the lubrication pipe on the engine. Thermocouple was fill in the small hole and seal with epoxy from Selleys. Leave the epoxy to dry and reach it full strength for 24 hour then wrap with Silicaflex™ Tape AB. For the exhaust, thermocouple was clamped with using stainless steel pipe clamp 30mm in diameter and wrap using Silicaflex™ Tape AB. The layout of the experimental setup is shown in Figure 3. Thermocouple type K were used and connected to the PICO USB TC-08 thermocouple data logger.

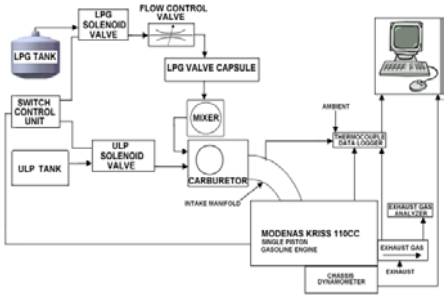


Figure 20: Experimental lay-out

EXPERIMENTAL PROCEDURE

Engine was tested on control environment to minimize correction factor. Data was obtained under stabilized operating conditions with adequate fresh air supply to engine. Temperature of the inlet air to the engine was measured within 0.30 m upstream of air inlet ductwork. Engine was warm up for five minutes in idle condition and no data was taken until temperatures were maintained constant for one minute. Test engine were analyze on engine speed 2500rpm with no loads.

First series featured engine running on ULP, while the second one was registered for LPG operation. Fuel consumption was measured respectively for petrol with the use of precise Pierburg PLU 401 device, while gaseous fuel consumption was registered by a tensometric balance. All tests completed on the Modenas Kriss 110cc engine were done for stochiometric mixtures being increase to 16.56 for LPG mode series and with ignition spark timing remain same for both series. In examine the fuel consumption the test engine was run on variety of engine speed from 1000rpm to 5000rpm. Engine was warm up for five minute and no data was recorded during warm up.

RESULTS AND DISCUSSION

Figure 4 shows the temperature on the exhaust of engine fueled by ULP and LPG. As liquid fuels have latent heat of vaporization, they also act as a cooling agent on intake charge during vaporization.

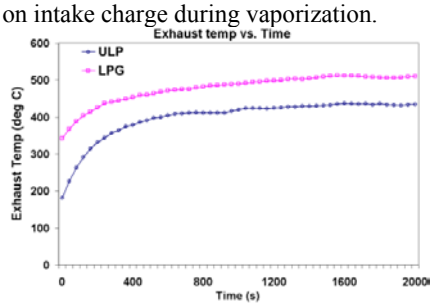


Figure 21: Exhaust Temperature versus Time

Therefore, ULP enters the combustion chamber as vapor, there will be an increase in intake mixture density and consequently in volumetric efficiency, but gaseous fuels which are vapor in ambient temperature, not only have no cooling effect, but also be a factor in decreasing the volumetric efficiency, due to larger volume of fuel in inlet mixture [8]. Engine fueled by LPG need to use high quality exhaust valve where it can work on high temperature. Conventional exhaust valve was dedicated to work on ULP fuel so if the engines were fueled by LPG, exhaust valve could experience damage which is broke or bend. Engine piston also face the same situation where temperature is direct proportion to pressure, in other word if the temperature rise, pressure will experience the same thing, pressure rise. As the pressure and temperature rise engine piston have a chance to fail. As the engine piston and/or exhaust valve fail, the other engine component which is engine block, cylinder head, connecting rod and ball bearing will fall into damage. If lucky, damage will vine until drive train and if that happen, it can endanger motorcycle rider. Other component damage that cause from high temperature is leak, seal like O ring, gasket and oil seal can melt if expose to the high temperature with long period and of course leakage happen.

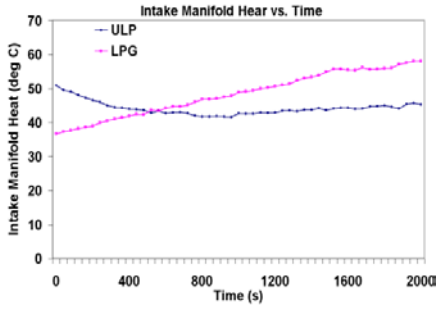


Figure 22: Intake Manifold Heat vs. Time

As the LPG fuel has no cooling effect, this can be proving with referring to the intake manifold temperature (Figure 5). Engine where in idling condition, speed around 1000rpm to 1100rpm, fuel enter the combustion chamber are just a small amount and at the same time fuel should flow into the intake manifold before enter the combustion chamber. In idle condition the cooling effect from the ULP fuel is less while gaseous fuel as describe before, the heat is almost totally discharge to the exhaust. When the engine is running on high speed, more fuel was entering the combustion chamber so the liquid fuel play they role to be the cooling agent. That's one of the advantage of using liquid fuel, while gaseous fuel has no cooling effect and much fuel enter the combustion chamber, so the temperature of the intake manifold is accelerate increase.

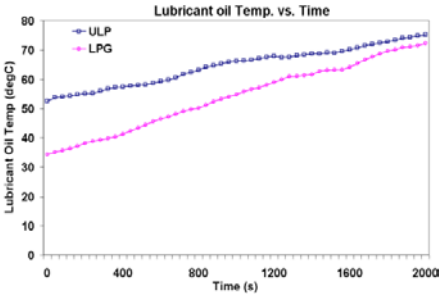


Figure 23: Lubricant oil temperature vs. Time

As the engine is warming up on idle condition where engine speed is about 1000rpm to 1100rpm, lubrication oil doesn't absorb much the heat release due to the combustion of LPG fuel. This phenomenon could be due to the density of the LPG, where LPG burn in combustion chamber as gas and the heat produce and combustion product is easily discharge to the exhaust. Maximum temperature of the lubricant oil is about 80°C for both modes. Lubrication oil not just only acts as the lubricant, it also works as the cooling agent to the engine. As the engine was cooling by air, to get the benefit from lubrication oil as cooling agent from lubrication oil, aluminum oil cooler can be use where it act as heat exchanger as radiator works from vehicle that cooled by water.

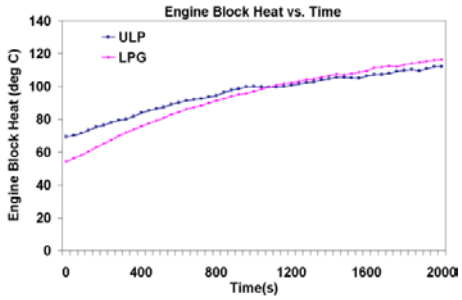


Figure 24: Engine Block Heat vs. Time

Engine block was designed with using material that can absorb heat and release to the ambient through the cooling fin provided. But if the temperature is too high, engine piston will expand and finally get stuck inside the engine block. If that happen, engine may stop running.

Analysis on fuel consumption as shown on Figure 6 determine that on LPG mode, engine use more fuel compared to ULP. On fuel consumption vs. engine speed curve it shown that LPG engine fueled by LPG used more fuel on every engine speed compared to ULP on average 15% from overall engine speed. This phenomenon occur because of the properties of the fuel it self, where LPG has a lower energy density than ULP by volume, so it need more fuel to compete with ULP in order to reach certain rpm.

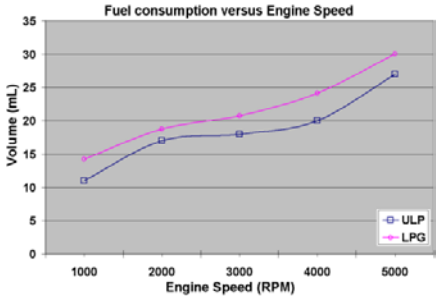


Figure 6: Fuel consumption versus engine speed

As the engines fueled by LPG require more fuel in order to reach certain engine speed (rpm), it doesn't tell us that LPG is not efficient. LPG is the efficient fuel for vehicle, where LPG has a higher energy density by weight; therefore, the weight of a tank full of LPG is similar to that of one filled with ULP [8]. LPG has higher energy content by weight, so it can take a vehicle farther on an average-capacity tank than a similar tank of ULP fuels.

CONCLUSION

Temperature and fuel consumption characteristics of a single cylinder four-stroke motorcycle engine were experimentally measured when fueled by petrol and liquid petroleum gas. Liquid petroleum gas which is investigated in this paper has a common property that contributes to the some advantages and disadvantages relative to the conventional liquid fuels which is petrol. Petrol has a cooling effect that can absorb engine heat while LPG as a gaseous fuel not just only have no cooling effect but it also reduce the volumetric efficiency. Due to the high temperature of the engine, damage can occur to the engine component. As the engine fueled by LPG, engine component that expose to the high temperature during combustion should be replace with high performance part. In order to overcome over heat problem, engine that cooled by air can apply the heat exchanger to the lubrication oil. LPG is the efficient fuel to the engine due to the high energy content by weight, where it can go much further compared to the engine fueled by ULP.

ACKNOWLEDGEMENT

I would like to thanks to my entire supervisor for his guidance on completing this project not forget to the technical staff from Universiti Teknikal Malaysia Melaka for their opinion, suggestion and cheering me.

REFERENCES

[1] K. Owen, T. Coley. Automotive Fuels Reference Book, second ed., ISBN: 1560915897 (1995).

[2] Autolocate, 2003. Available from <http://www.autolocate.co.uk/features/lpg>.

[3] D.G. Snelgrove, P. Dupont, R. Bonetto. An investigation into the influence of LPG (Autogas) composition on the exhaust emissions and fuel consumption of 3 bi-fuelled renault vehicles, SAE 961170. (1996).

[4] R.F. Klausmeier, I.F. Billick. Comparative analysis of the environmental impact of alternative transportation fuels, Energy & Fuels 7 1–2, ISSN 0887-0624. (1993).

[5] D.Y. Wu, R.D. Matthews, J. Zheng, K. Shen, J. Chiu, C. Mock, S. Jaeger, Texas Project: Part 3—cycle emissions of light-duty vehicles operating on CNG, LPG, Federal Phase 1 reformulated gasoline and/or low sulphur certification gasoline, vol. 1208, SAE Special Publications, pp. 385–414. (1996).

[6] M.S. Newkirk, L.R. Smith, M.E. Payne, J.S. Segal. Reactivity and exhaust emissions from an EHC-equipped LPG conversion vehicle operating on butane/propane fuel blends, vol. 1208, SAE Special Publications, pp.195– 206. (1996).

[7] Material Safety Data Sheet for Silicaflex™ Tape AB, (2008).

[8] Michelle Heath 2008, "Alternative fuels for vehicles", in AccessScience@McGraw-Hill, http://www.accessscience.com, DOI 10.1036/1097-8542.757512 (2008).

[9] Ali M. Pourkhesalian, Amir H. Shamekhi, Farhad Salimi. Alternative fuel and gasoline in an SI engine: A comparative study of performance and emissions characteristics. Elsevier, Fuel vol. 89 pp. 1056 – 1063. (2009).

One Dimensional Finite Element Method (Fem) Using Galerkin Approach of Heat Distribution on Printed Circuit Board

[1] Rahifa Ranom, [2] Mohd Norhisham Che Soh, [3] Ahmad Fuad Ab. Ghani
[1,2] Faculty of Electrical Engineering, Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia
[3] Faculty of Mechanical Engineering, Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia
[1] Email: rahifa@utem.edu.my, [2] Email: mud_hisham@yahoo.com, [3] Email: ahmadfuad@utem.edu.my

Abstract
In designing PCB current carrying conductors, it is required take into account heat distribution effect due to electrical current and some parameters that may have significant impact on it. Damage of this PCB current carrying conductor may eventually results in the PCB being exposed to the higher temperature than usual which may cause PCB current carrying conductor to fail. The objective of this paper is to analyze one dimensional heat distribution on PCB current carrying conductors using Finite Element Method, (FEM) via Galerkin approach. An experiment has been performed to capture the data using FLIR i5 Infrared Thermal Imager. The PCB with varied value of parameters such as width is supplied with different range of direct current, (DC) from 0.5 to 5 Amperes. The flow of current through a copper conductor of PCB will cause the temperature of the trace to increase. The cross sectional area, A which is trace thickness x width will affect the resistance of the trace. The formula of power is I^2*R then summarized the relationship between temperature and current is a function of current, trace width and thickness. The functions obtained are then used to model the heat distribution on PCB using FEM via Galerkin approach. An algorithm has been developed by using MATLAB. The numerical results then compared with an experimental. An error obtained divided into three range of error tolerance. A maximum average error traced from 5 mm t 20 mm is $2.363°C$ while minimum average error traced from 20 mm to total distance is $0.3678°C$. From analysis of data based on FEM analysis and comparing with experiment, the suitable heat transfer film coefficient is obtained. The heat transfer film coefficient is a combination of convection and radiation process on PCB. By considering of all geometric parameters, the heat transfer film coefficient is proved to be the primary parameter's influencing the validation of Galerkin method while next parameters is cross sectional area. Finally, result is tabulated and present graphically to display the heat distribution on the PCB current carrying conductor.

Keyword
Finite Element Method (FEM), Galerkin Method, Heat Distribution, Printed Circuit Board.

INTRODUCTION

In PCB design, thermal management is one of the important considerations [1]. By supplying different constant current input to the PCB current carrying conductor, heat is generated on copper conductor. The heat is then distributed and dissipated on the PCB and surrounding which is called heat exchanger. This heat exchanger is occurred to equalize the temperature between PCB and surrounding. There are three way of heat exchange process: convection heat exchange, radiation heat transfer and conduction heat exchange [2].

The PCB is heat up due to conduction process. Heat from the copper conductor is distributed away to the PCB. Since the PCB is heat up, the surrounding air is also heat up. Then, the heat air is moved and carried energy away from the board. The energy is transferred to the air by convection. At the same time, the hot sections of the board radiate energy away from the board and transfer energy from the board to the surroundings. Conduction through the PCB is almost constant for different ambient temperature [1]. Thus, convection into the surrounding air becomes a critical parameter which affects the temperature rise on the PCB while radiation is assume has a least effect to the temperature rise. Besides, there are other parameters that affect the heat distribution on PCB such as PCB size and thickness, number of traces that are involved in current carrying, traces separation, allowable temperature rise, copper volume percentage and trace cross-sectional area.

The heat is distributed and dissipated which potentially result in the PCB current carrying conductor fails. This situation requires scheduled preventive maintenance activities as well as high maintaining cost. By predicting the temperature rise on the PCB current carrying conductor for various current supplied, a failure of the PCB can be minimized. Therefore, some

calculation to find out the requirement of the PCB current carrying conductor due to temperature rise is required in constructing the PCB. There are a lot of methods to study the heat distribution and dissipation and then predict the temperature rise on PCB. One of the method is by using FEM via Galerkin approach [3].

This paper is focused on study of Galerkin approach for solving the heat distribution and dissipation on PCB. The experiment will be setup to capture the data using FLIR i5 Infrared Thermal Imager. The data from the experiment will use to compare with calculation. The analysis based on FEM will obtained the heat transfer film coefficient which is combination of convection and radiation into singular term [1]. Finally, by using the suitable value of film coefficient, the Galerkin approach is validated.

THEORY

The FEM is an efficient method for solving heat distribution. Galerkin approach which is one of the FEM can be used to derive the heat transfer problem. This method is extremely crucial for the effectiveness of results. It can perform lots of calculations with various loading and meshing conditions [4]. It is believed that Galerkin approach is the best method to visualize the temperature distribution in this study. MATLAB software is used to develop an algorithm for Galerkin approach. For a one-dimensional heat transfer problem, the governing differential equation is given by

$$k\frac{d^2T}{dx^2} + q = 0 \qquad \{1\}$$

The boundary conditions are (combined heat flux and convection specified):

$$T(x=0) = T_0 \quad \text{(Temperature specified)} \qquad \{2\}$$

$$k\frac{dT}{dx}l_x + h(T - T_\infty) + q = 0 \quad \text{on the surface} \qquad \{3\}$$

One end of the PCB is connected to a heat source whose temperature is known (edge of copper conductor) and heat will be lost to the surroundings through the perimeter surface and the end. We shall now consider the analysis of straight line copper conductor on PCB.

The finite element procedure using Galerkin method for one-dimensional problems can be described by the following steps [3]:

Step 1: Idealize the PCB layer into several finite elements.
Step 2: Assume a linear temperature variation inside any elements "e".
Step 3: Derive the element matrices.
Step 4: Assembled equations.

The element matrices can be assembled to obtain the overall equations is:

$$\left[\underset{\sim}{K}_3\right]\dot{\vec{T}} + \left[\underset{\sim}{K}\right]\vec{T} = \vec{P} \qquad \{4\}$$

where

$$\left[\underset{\sim}{K}_3\right] = \sum_{e-1}^{E}\left[K_3^e\right] = 0 \qquad \{5\}$$

Thus,

$$\left[\underset{\sim}{K}\right]\vec{T} = \vec{P} \qquad \{6\}$$

Step 5: The assembled equations {6} are to be solved, to find the nodal temperatures.

Three assumptions have been done which are:

1. $\dot{q} = 0$ (no internal heat source) and $q = 0$ (no surface heat flux).
2. The heat is uniform in an element 'e'. Since, there is no electronic component on PCB, the heat should be uniform.
3. The thickness of PCB is too small. Therefore assumption of a unit thickness can be made where temperature on top and bottom of PCB should be same.

EXPERIMENT

An experiment is performed to measure the temperature rise on PCB. A completed data from the experiment is required to compare and validate with the calculation using Galerkin approach. In order to perform and experiment, a PCB has been designed. The PCB is designed based on previous researches, [5] and [6]. A single straight line of copper conductor is laying out on single sided FR4 PCB as shown in

Figure 25 and then supplied with direct current in range of 0.5A to 5A.

Table 10 shows the completed list of parameters on PCB design.

Table 10: List of parameters for PCB design

Parameters	Value (mm)
Trace's Length, L	37
Copper's Width	1
Copper's Length	240
Copper's Thickness	0.03556
PCB's Width	74
PCB's Length	300
PCB's Thickness	1.6

The conductor temperature is recorded after temperature rises and reach steady state condition which is 9 minutes after being supplied by constant current. Heat flow, Q through conductor of PCB is represented by current input on the conductor. Q is proportional to the current, I and resistance, R_e. Resistance of conductor is measured at ambient temperature, T_i.

$$Q = I^2 R_e \quad \{7\}$$

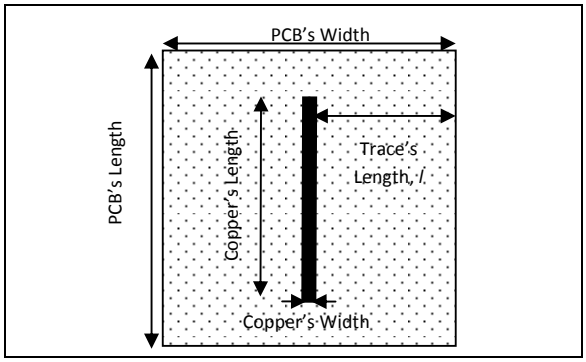


Figure 25: Front view of PCB design

A temperature image is recorded by using FLIR i5 Infrared Thermal Imager at the top and bottom of PCB along the copper conductor. It is found that the temperature is almost same for both sides due to the thickness of PCB. The fact that the temperature variation across PCB thickness is very small suggests that the location of the PCB traces along the thickness shouldn't have much impact on the temperature rise [7]. Since the length of conductor is larger than the width, it is assumed no heat flowing along the length of conductor but the heat is distribute away from the edge of copper conductor to PCB and surrounding. Thus, a copper conductor is assumed as a heat source. The cross sectional area, A of heat source now can be calculated using:

$$A = W \times T_{PCB} \quad \{8\}$$

where

W = width (copper's length).
T_{PCB} = thickness of PCB.

However, it is not the purpose of this paper to study the relationship between cross sectional area and the heat transfer film coefficient. Since the cross sectional area increases, the rate of convection and radiation also increases while the conduction is state as constant. In this project, the fixed width is set at 10 mm.

RESULT

Figure 26 presents the temperature distribution on the surfaces across the conductor with current supplied is 3A. The conductor is state as centre of temperature image. The symmetrical shape of imaging profile means that the heat is distributed same for both directions. Thus, only one side of heat distribution direction on PCB is considered for next analysis and comparison with manual calculation.

The PCB is supplied with constant DC in range of 0.5A to 5A. The temperature traces at the edge of copper which shows the effect of the different DC supplied is plotted in Figure 27. Then, by using regression method, a quadratic equation obtained is used to curve the plotted results. That equation is used to predict the initial temperature at the heat source with different DC supplied. Obviously, increasing the current will lead to temperature. Using equation (8), supplied more current will increase the power while the resistance is fixed.

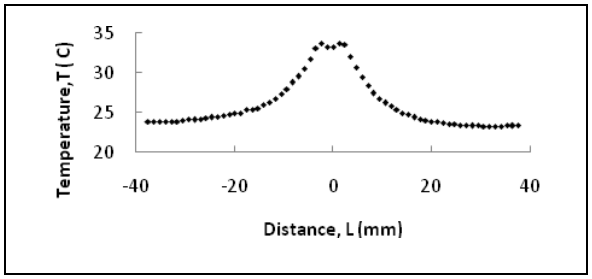


Figure 26: Infrared thermal imaging profile of PCB supplied with 3A DC.

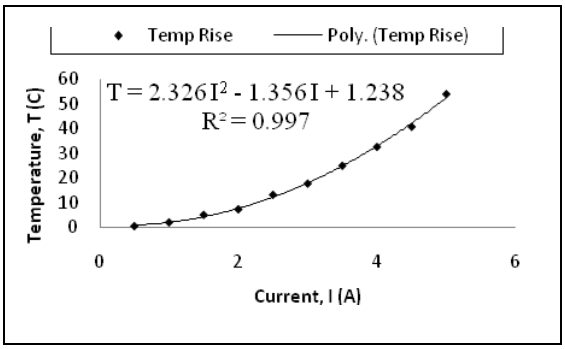


Figure 27: Temperature rise on PCB supplied with current, 0.5A to 5A.

ANALYSIS OF EXPERIMENTAL DATA

The mechanism that cause the temperature rise on PCB is identified. Since most parameters is fixed, the heat transfer film coefficient, h is the main parameters will be focused. The algorithm developed using MATLAB is used for simulation. This algorithm is applied to find out the suitable value of film coefficient.

Comparison is done to obtained an error where error is the temperature different between experimental data and calculation. In this study, the suitable error

tolerance take into account is in range of ± 5. The different temperature can be analyzed into three different range of distance. The second range of distance from 5mm to 20 mm has a maximum average error while minimum average error can be traces on range from 20mm to total distance. The error on second range is about six times higher compare with the minimum error. However, that error is still in range of an error tolerance. For future study, a modification of mathematical algorithm will be done continuously until minimum error is obtained.

The analysisof errors are summarizedas shown in Table 11. The total average error is 1.324. From Table 11, it show that the result of calculation has a minimum different with experiment data means this approach is able to predict the temperature rise on PCB.

Table 11: Summarized error in different range of distance.

Distance, L (mm)	Average Error
$0 \le L < 5$	1.325
$5 \le L < 20$	2.363
$20 \le L < 37$	0.3678

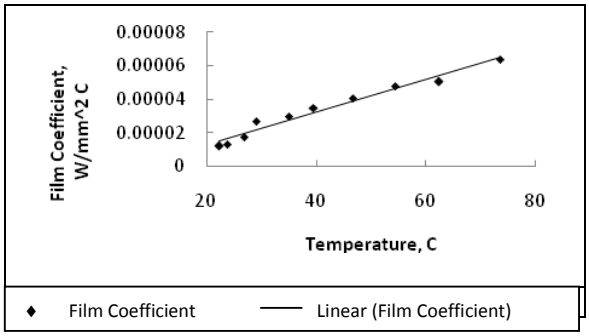


Figure 28: Heat transfer film coefficient at different temperature calculated using FEM.

The convection film coefficient is required as input due to the free air convection involved. Although, a fixed value is unknown, film coefficient with different value is applied until the results match with experimental values. The film coefficient is treated as combination of convection and radiation. The film coefficient obtained using algorithm is plotted against temperature of the copper conductor, as shown in Figure 28.

Then, an analysis is done for determining rate of heat dissipation by using linear regressionof curve fitting. A linear relationship with temperature, T is:

$$h = aT + b \qquad \{9\}$$

where

h in unit of $W/mm^2\,°C$

T in unit of $°C$

$a = 1\times10^{-6}\ W/mm^2°C^2$, and

$b = 6\times10^{-6}\ W/mm^2°C$

CONCLUSION

Interesting results are seen for both experiment and calculation using Galerkin approach. The relation between current supplied and temperature rise is obtained. Thus, a temperature rise can be predicted for any current supplied.

Finite Element Method via Galerkin approach used to solve heat distribution and dissipation is also discussed. The film coefficient is obtained by using the algorithm derived using MATLAB followed by analysis of error. A minimum error was obtained by apply that film coefficient and then the Galerkin approach is verified with experimental values.

Since the Galerkin approach is verified, the method is able to simulate and predict the temperature rise on PCB with different parameters applied. This method will bring a lot of benefit such the time consuming, computational saving and reduce cost.

More investigations are required to study the effect of other parameters to the temperature rise. Besides, to more precisely predict the temperature rise, a two dimensional Galerkin approach is suitable to apply. This process will include analysis, verifications, and also redesign of both experimental and algorithm. It will be future work.

ACKNOWLEDGEMENT

We wish to acknowledge Assoc Prof. Dr. Ismadi Bugis, Pn Irma Jamaludin and En Asri Din for their valuable discussion and suggestions; and FRGS fund for this project.

REFERENCE

[1] T. Y. Pan*, et al.*, "Current carrying capacity of copper conductors in printed wiring boards," in *Electronic Components and Technology Conference, 1993. Proceedings., 43rd*, 1993, pp. 1061-1066.

[2] F. Kreith and M. Bohn, "Principles of heat transfer," 1986.

[3] S. Rao, *The finite element method in engineering*: Butterworth-heinemann, 2005.

[4] L. Gray and B. Griffith, "A faster Galerkin boundary integral algorithm," *Communications in Numerical Methods in Engineering,* vol. 14, pp. 1109-1117, 1998.

[5] W. Yi*, et al.*, "Thermal design guideline of PCB traces under DC and AC current," in *Energy Conversion Congress and Exposition, 2009. ECCE 2009. IEEE*, 2009, pp. 1240-1246.

[6] J. Adam*, et al.*, "New correlations between electrical current and temperature rise in PCB traces," 2004, pp. 292-299.

[7] L. Yun, "On current carrying capacities of PCB traces," in *Electronic Components and Technology Conference, 2002. Proceedings. 52nd*, 2002, pp. 1683-1693.

Improving Image Management Process Efficiency

M.S Syed Mohamed[1*]
[1]Faculty of Manufacturing Engineering,
Universiti Teknikal Malaysia Melaka, Durian Tunggal, 76109 Melaka, Malaysia
*syafiq@utem.edu.my

Abstract
Managing enormous volumes of patient medical records can be an arduous task. X Image Management Department, Wisconsin, USA maintains medical records from hospitals and clinics. It is imperative that these medical records are handled in the most efficient and quickest manner possible to ensure patient care is at the maximum. The objective of this project was to improve the accuracy and efficiency of the medical records purging process. A *Kaizen approach was used at* X Image Management Department *to identify unnecessary motions and procedures during medical records purging process. As a result, medical records purging time for a section of folders was reduced from 15.41 minutes to 6.08 minutes. The project demonstrated the power of small, continuous improvements in a company.*

Keywords
Kaizen, medical records, efficiency.

INTRODUCTION

The healthcare industry in the United States is a booming industry. Statistics from the Office of the Actuary (OACT) of the Centers for Medicare and Medicaid Services reported that on the average in 2007, USD 2.26 trillion on health care was spent [1]. Such enormous amounts of financial commitments would dictate higher expectations of quality in healthcare delivery. In light of the situation, X Image Management Department* in Wisconsin, USA attempted to improve their medical records management process. X Image Management Department is an organization that manages medical records and radiology images from clinics and hospitals around Wisconsin. It's a centralized department wherein the medical records that contain the history of each and every patient are preserved for future reference.

Over the time, the number of medical records grew very large. X Image Management Department needed to move some of the older medical records to a warehouse for archival purposes. The movement of medical records to the warehouse was termed as the "purging process". The purging process was deemed to

*name has been withheld

be necessary as X Image Management Department has limited amount of space to store patient medical records.

LITERATURE REVIEW

Continuous Improvement Methods

Healthcare organizations around the globe have been implementing various different continuous improvements methods in order to improve efficiency in their operations. One such method is called Kaizen. Kaizen is a Japanese term for "improvement". Kaizen started in companies and organizations in Japan who understood the need for small, continual improvement. A very successful example of Kaizen can be seen in the Toyota Production System (TPS). In TPS, the main objective is to identify and eliminate "Muda," or waste in all areas, including the production process.

As a result of Kaizen's huge success in Japan, companies outside Japan began to emulate the Kaizen method. After witnessing the success of Kaizen in many companies, healthcare organizations began attempting to implement Kaizen to improve their operations [2].

One such organization is the University of Iowa Hospital and Clinics (UIHC). UIHC used the Kaizen methodology to identify and eliminate non value added activities in radiology CT scanning. A cross functional team of 15 people was formed for the 3 day Kaizen event. The team analyzed the CT scanning process and a new workflow was created. The results from the Kaizen event were impressive; a revenue increase of USD 750,000 per year was achieved [3].

Other continuous improvement approaches in healthcare

Apart from Kaizen method, various other organizations have implemented other methods and techniques for improving their business process. Varkey et al [4] implemented a PDSA (plan, do, study and act) cycles to improve a medical reconciliation process. A medical reconciliation process is a process of ensuring the accuracy of medications. Varkey et al designed a data collection form to assess the medication usage among patients. The data collection form was then redesigned to make it more patient and physician friendly. As a result, errors were reduced by more than 50%. The newly designed data collection form led to a new medical reconciliation process, which was then implemented in that clinic.

Lean Six Sigma is another approach that is slowly gaining popularity in healthcare. A successful example can be seen at Charleston, West Virginia. Six-sigma

methodology was used to evaluate and improve its rate of colon and vascular surgical site infections [4]. The surgical site infection rate was decreased by 91%. Potential financial savings were in excess of USD 1 million [4].

METHODOLOGY

Continuous improvement methods such as Kaizen, Lean Sigma, PDSA were proven to be beneficial for healthcare organizations. In light of this, the Kaizen methodology was chosen by X Image Management Department to improve the medical records purging process.

As with any Kaizen activity, the project is divided into several phases, i.e. plan, do, check and act. In the planning phase a Kaizen team was formed. The team was then given a walkthrough of the medical records purging process. The purging process was done on a stack of medical records at a time. A stack of medical records is referred to as "sections". One section comprises of one part of a folder rack that is roughly 1.5 feet wide and 0.5 feet tall.

A baseline measure was taken to measure the time needed to purge one section of medical records. The baseline measure for the patient folder purging process is explained below:

- Time taken for processing one section = 14.23 minutes
- Total number of sections (Existing sections + New incoming sections) = 3231
- Assuming work hours of 5 days / week and 6 hours/ day
- Total time taken for processing all the sections using the older method = 26 weeks

In the "do" phase, it involves constructing a process map, affinity diagram and a walkthrough of the medical record purging process. The process map would enable the Kaizen team to understand the purging process better. As large amounts of ideas were gathered through the process of brainstorming, the affinity diagram helped organize the ideas into natural relationship groupings. Lastly, the walkthrough of the medical records purging process enabled the Kaizen team to observe the process in detail, and note down any areas of improvement.

The third and the last phase are "check" and "act". "Check" phase involves monitoring the medical records purging process results and the "act" phase to sustain the improvements made.

RESULTS AND DISCUSSION

A walkthrough of the medical records purging process helped the Kaizen team to understand the process in greater detail. Before the purging process begins, the management of X Image Management Department had to decide which medical records to be purged. It was decided that the medical records that those medical records which do not contain any recent updates for year 2006 would be purged from the facility. The purging process involved medical records from the year 2003 until 2006.

A brief description of the purging process is as follows: 1) Choosing the files from shelves, 2) Loading the files in the cart, 3) Moving files to scanning station 4) Scan files and put stickers, 5) Put old files (no recent entries) at different shelf, 6) Taking files with recent update back to the shelf.

An observation was carried out by the Kaizen team and several potential areas of improvements were noted. One of the first problems was the amount of redundancy in the process leading to the very high purging time. The process starts with the folders being retrieved from the racks and placing them in carts to carry them to the scanning workstation. The folders are scanned at the workstation and folders without any recent updates are sent to the warehouse and the rest are placed back in the shelves. A significant non value added time was noticed during the process of carrying the folders from the shelves to the workstation, and returning the folders to the shelves for arranging.

Following the observation, the Kaizen team went on to identify the main issues surrounding the medical records purging process. A large amount of unsorted ideas were obtained, and therefore an affinity diagram were constructed (Appendix). Some of the main issues were: The major areas that the Kaizen team decided to concentrate on were: 1) Inefficiency in data capturing, 2) Retrieving and managing folders, 3) Support from management, 4) Utilization of facility, 5) Arrangement of workstation and folder purging process. Several solutions were suggested by the Kaizen team to improve the medical records purging process:

- Mobile scanning station - In the current process, the patient folders are carried to the static workstation (desktop), where they are scanned and updated. Based on the update, they are either sent back to the shelves or warehouse. Two steps (carrying the folders to the desktop and taking them back to the shelves) are found to be redundant. By having a mobile workstation, the redundancies can be eliminated.
- New method of folder retrieval - Patient folders are arranged in the racks based on the labels attached to the patient folder. The labels indicate the shelf number, rack number and the year of the patient folder. A typical rack contains folders from the years 2003-2006. The scanning of the folders currently is done a single year at a time. As a typical rack contains folders from various years, retrieval of folders pertaining to a single year is difficult. Pulling out folders pertaining to multiple years and scanning them can be more efficient for folder retrieval.

- Workstation arrangement – The existing workstation are found to be cluttered with labels, power cords, internet cables and the scanning gun. The labels were randomly scattered on the table previously and identifying and attaching the appropriate tag was difficult. In order to enable an easier access of the labels, a band was used to fix the label rolls in place. The power and internet cables were organized neatly to ensure the workstation is clutter free.

In order to gauge the effectiveness of solutions proposed, the total time taken to process one section was measured for each type of solution. The total time for each solution is shown below:

Table 1: Comparison of methods

Methods	Average time taken (minutes)
Existing Method	15.41
Solution 1 (Mobile Workstation)	8.31
Solution 2 (Combined retrieval of folders)	6.24
Solution 3 (Arrange the stickers)	6.08

It should be noted here that solution 3 is comprised of having all the 3 solutions combined i.e. having the mobile workstation, combined retrieval of folders and sticker arrangements. Compared to the original method, the new method (solution 3) has managed to cut the purging time by 50%.

The average time taken for the new method to purge one section is 6.08 minutes. Total number of sections at that time was 3231. By assuming a working hours of 5 days per week and 6 hours per day, the total time taken for processing all the sections using the new method would be 11 weeks.

CONCLUSION

The Kaizen team was tasked with the problem of improving the efficiency of the medical records purging process. The problem was analyzed thoroughly using some of the process improvement tools such as the affinity diagram and the process map.

After using all the tools, some recommendations were made. The scanning station should be moved closer to the racks. Not only was that, a combined retrieval of folders and the organization of labels were proposed. All the methods recommended by the Kaizen team were put in practice with wonderful results.

The results encouraged X Image Management Department to adapt the new methods as it is beneficial for them. From now on, the medical records purging process will utilize the mobile scanning station with the combined retrieval method to speed up the process.

ACKNOWLEDGMENTS

The author would like to thank Rhonda Struck and Mike Gathy for allowing us to work on this project. To Gautham P Rajappa, Andreas Kuncoro,Srikanth Yaddanapudi, thank you for your efforts in this project.

REFERENCES

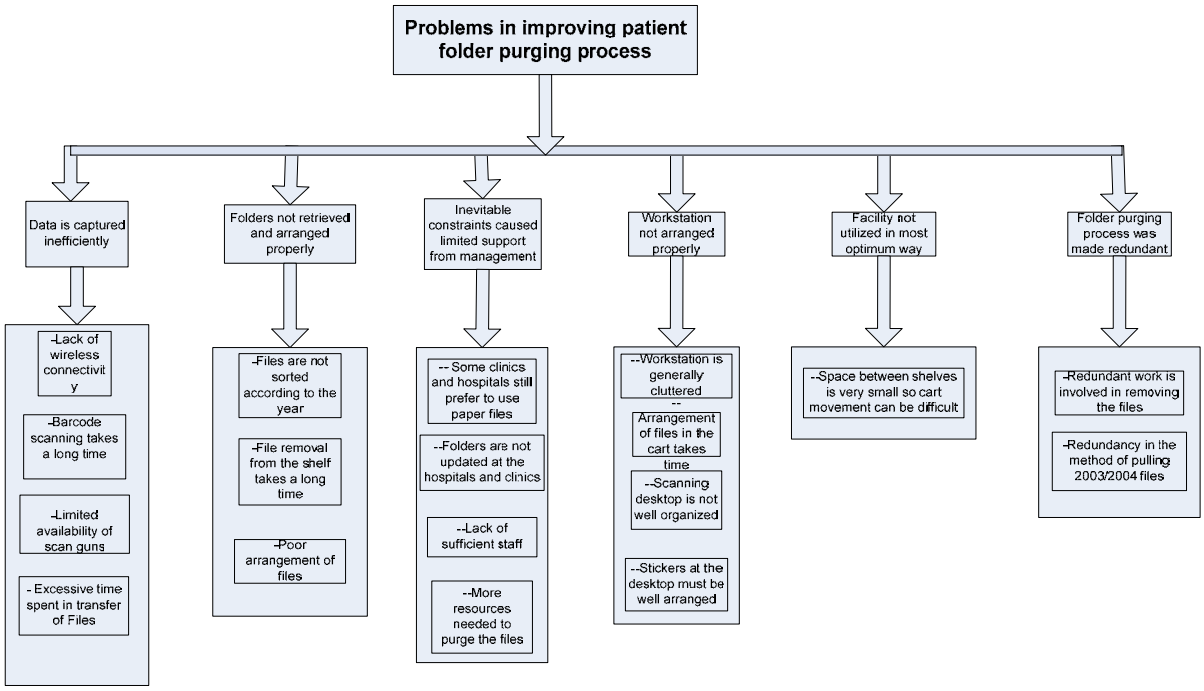
[1] National Health Expenditures, Forecast summary and selected tables, Office of the Actuary in the Centers for Medicare & Medicaid Services, 2008. Retrieved Sept 14th, 2010.

[2] Berwick, D.M (1989). Continuous improvement as an ideal in health care. *New England Journal of Medicine, 320*, 53-56.

[3] Bahensky J.A., Roe J., Bolton, R. (2005) Lean Sigma: will it work for healthcare? *Journal of Healthcare Information Management, 19*,39-44.

[4] Varkey P, Cunningham J, Bisping S (2007) Medication reconciliation in the outpatient setting. *Joint Commission Journal Quality Patient Safety, 33*, 286-292.

Appendix


Problems in improving patient folder purging process
Data is captured inefficiently
-Lack of wireless connectivit y
-Barcode scanning takes a long time
-Limited availability of scan guns
- Excessive time spent in transfer of Files
Folders not retrieved and arranged properly
-Files are not sorted according to the year
-File removal from the shelf takes a long time
-Poor arrangement of files
Inevitable constraints caused limited support from management
-- Some clinics and hospitals still prefer to use paper files
--Folders are not updated at the hospitals and clinics
--Lack of sufficient staff
--More resources needed to purge the files
Workstation not arranged properly
--Workstation is generally cluttered --
Arrangement of files in the cart takes time
--Scanning desktop is not well organized
--Stickers at the desktop must be well arranged
Facility not utilized in most optimum way
--Space between shelves is very small so cart movement can be difficult
Folder purging process was made redundant
-Redundant work is involved in removing the files
-Redundancy in the method of pulling 2003/2004 files

Efficient Medium Access Control (MAC) Protocol by Improving the Channel Utilization and Reducing the Overhead in Multi-Hop Wireless Mesh

Vigneswara Rao Gannapathy[1,*], Mohd Riduan bin Ahmad[1],
Mohamad Kadim bin Suaidi[1], Muhammad Syahrir bin Johal[1]
[1]Universiti Teknikal Malaysia Melaka (UTeM)
*vigneswara@utem.edu.my

Abstract
The IEEE 802.11 Distributed Coordination Function (DCF) Medium Access Control (MAC) protocol is the main element that determines the efficiency in sharing the limited communication bandwidth of wireless channel. This protocol uses Carrier Sense Multiple AccesswithCollisionAvoidance (CSMA/ CA) to facilitate medium sharing between contending nodes. However, this technique continues suffers from throughput degradation when applied in multi-hop Wireless Mesh Network (WMN). This technique which is implemented with Request-to-Send/Clear-to-Send (RTS/CTS) signaling partially solved hidden node problems however the exposed node problems remain unaddressed. These exposed nodes lead to throughput degradation especially when the transmission in multi-hop networks is considered. Moreover, since multi-hop mesh network transfer the data packet via intermediate nodes, the amount of control signaling that needed at each intermediate node significantly reduces the throughput. The enhancement to the IEEE 802.11 DCF MAC Protocol was described to enable nodes schedule concurrent transmission whenever possible, thus improving channel utilization and mitigating exposed node problem. The enhancementis also done to reduce the signaling overhead required at every hop until the data packet reaches its destination. The multi-hop network performances are evaluated in terms of throughput and delay. It is proven by using MATLAB simulation tool that this enhancement provides significant improvement in throughput. The protocol outperforms the existing IEEE DCF MAC and increase in overall throughput of multi-hop WMN.

Keywords
Concurrent Transmission; Reduce Signaling Packets; MAC Protocol; Multi-hop WMNs

INTRODUCTION

The wireless mesh networks has become as a promising technology for future broadband wireless access. It has huge potential for providing campus- wide network coverage and bringing broadband internet connectivity to remote and rural area. When applying mesh networking techniques over shared medium with limited bandwidth, many new challenges are raised. One of the challenges is in providing effective efficient Medium Access Control (MAC).

Medium Access Control (MAC) protocols employed in multi-hop WMNs to resolve contentions for accessing the shared medium which is encountered many issues especially exposed node problems and large overhead due to its unique characteristics and multi-hop communications [1,2]. Apart from that as the number of hops in WMNs increases, the optimal overall throughput of existing MAC protocol and its derivatives are not achievable. So, the enhancements of the existing IEEE 802.11 Distributed Coordination Function (DCF) MAC protocol have been proposed in this work.

Concurrent transmission has been proposed as a transmission strategy to combat exposed node problems in order to improve the overall throughput of multi-hop WMNs. The earliest work on enabling concurrent transmission in WMNs is Cooperative Medium Access Scheme [4] that contributes to significant improvement in the overall throughput of WMN. This work is further improved by [5] with the introduction of Multiple Access Collision Avoidance- Parallel or MACA-P protocol. The enhancement is made by introducing a control gap between the RTS/CTS exchange and invite all other possible nodes to concurrently initiate their transmission. However MACA-P is only performing well for specific scenario when large size of payload is considered. In addition this protocol also causes wasted idle time due to scheduling of infeasible concurrent transmission at intermediate nodes especially when low traffic is considered in multi-hop communication. Another interesting work in [6] has proposed an enhancement to the existing IEEE 802.11 MAC by enabling the nodes to identify themselves as an exposed node and opportunistically schedule concurrent transmission whenever possible. However the protocol enables the concurrency by the exposed node which is caused by Network Allocation Vector (NAV) of RTS only.

Since the source node in WMN relaying its data packets over multiple hops until reach destination node, the large number of overhead due

to signaling at each intermediate hop will degrade the throughput significantly. Medium Access with Reduced Handshake (MARCH) protocol has been proposed to reduce the overhead of multi-hop network [7]. The RTS/CTS handshake only performed by the first hop of communicating nodes pair while the subsequent hops of communicating nodes pairs utilize a new signaling packet named as CTS-only. Since fewer signaling packets are exchanged over multiple hops, the overall throughput can be increased significantly. Moreover the probability of packet collision among the signaling packets has been reduced. However the protocol performs poorly when high traffic is considered in multi-hop network and when exposed node problem is occurred at the first hop of communicating nodes.

In this paper, we are focusing on how to reduce both the exposed node and large signaling overhead problems in multi-hop networks with high traffic scenario. The major contribution of this paper is the introduction of Concurrent transmission to alleviate the exposed node problem and reduces the number of signaling packets needed at intermediate hops until the data packet reaches its destination in multi-hop WMNs.

The rest of this paper is organized as follows. Section II presents the problem definition and the network model of the proposed system is presents in Section III. Then section IV describes the proposed operations and section V presents the performance model. Section VI explains the performance results and conclusion are given in Section VII.

NETWORK MODEL

The network we considered consists of *n* mesh routers, mesh clients and gateways. Gateways to the Internet are chosen from a set of *n* mesh routers. The other mesh routers are referred as intermediate mesh routers which is expanding the network coverage and providing reliable links to gateways. The network topology is shown in Figure 3.

Each mesh router is equipped with single interface except the gateway (another interface to Internet) and has a common transmission range, *r*. Both the mesh clients and mesh routers use the same Physical Layer (PHY) frequency band by which in this work we consider the use of IEEE 802.11 PHY [9]. The transmission rate is constant and packets are forwarded in a multi-hop fashion to the gateway. For ease of explanation and without loss of generality, we consider unidirectional traffic, i.e., traffic only going from mesh nodes to the gateway.

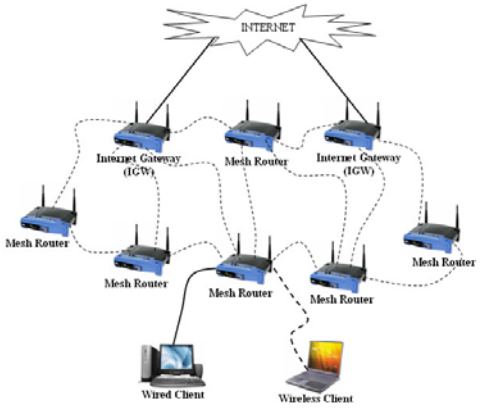


Fig. 3: Network topology

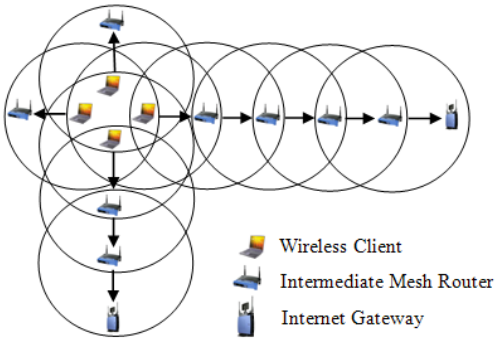


Fig. 4: Forward packet to gateway via intermediate router

We assume that each mesh router has a fixed transmission rate at 54 Mbps and range of 100 meters. Thus only two routers can set up a link (i.e within communication range) and communicate between them whenever possible. As for the mesh clients, some of them are associated to a certain mesh router forming a cell. Data packets originating from the cells are relayed concurrently by the intermediate mesh routers and hop by hop to Internet through the gateways as shown in Figure 4.

PROTOCOL DESCRIPTION

The proposed protocol enables concurrent transmission at the first hop when few nodes within communication range has data packet to be transmitted at the same time. On other hand, the proposed protocol also reduces the amount of control handshake when the nodes relaying data to the gateway in multi-hop fashion.

Let'sassumethat4clientsarewithin the communication range between each other as shown in Figure 4 have data packet to be transmitted at the same time. The novelty of the proposed protocol compared to existing IEEE 802.11 MAC is the introduction of some overhead to schedule the concurrent transmission for those 4 clients in order to enable concurrency in the mesh network. Please refer

Figure 5 to ease the explanation of concurrent transmission which is involving 2 clients.

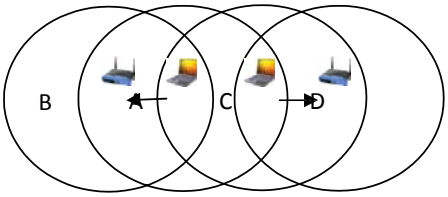


Fig. 5: Concurrent Transmission

Let's consider Figure 5, where client A and C are one hop neighbors and within communication range. During the transmission from client A to router B, a possible concurrent transmission from client C to router D does not permitted. This is because of current standard which is implemented virtual carrier sensing (RTS and CTS technique). The proposed approach was designed to enable such as concurrency without any collision. This transmission begins by client A by initiating a RTS/CTS exchange with router B. The enhancement was made in this RTS and CTS control packet by introducing new duration field in their frame structure. The duration field was designed to hold the DATA and ACK start time of that specific node. In this case, when client C overhears RTS control packet from client A, it will aware the scheduled DATA and ACK start time of client A to router B. Since client C aware the DATA and ACK start time of client A, thus it will schedule its transmission with router D at these start times. Figure 6 shows the timing diagram when enabling concurrent transmission.

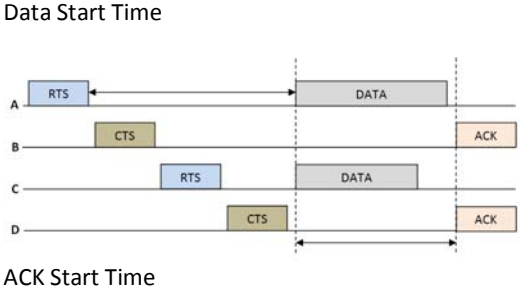


Fig. 6: Timing Diagram of Concurrent Transmission

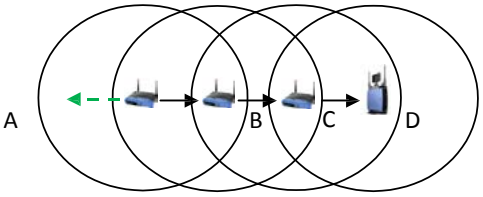


Fig. 7: Reduced Number of Control Handshakes

In multihop WMNs, the data packet has to be relayed via some intermediate hops (mesh routers) until it reaches the internet gateway as shown in Figure 7. We proposed some enhancement to existing 802.11 MAC to reduce the amount of signaling packet that require at every each intermediate nodes. Our proposed protocol exploits the omnidirectional broadcast characteristic to enhancement purposes. Since every each node in the network exploiting with omnidirectional broadcast characteristic has the capability of overhearing, this advantage can be used to convey the data packet to subsequent nodes. The signaling overhead is shortening by using timer mechanism. Let's consider Figure 7, the timer is activated once node B overheard CTS packet from node A. The duration of the timer is set to be equal to the time taken by a node A to receive its data packet from its respective source node and until it sends ACK packet to its respective source node. Upon timeout, the node B invites the node A to send the data packet by sending its CTS packet. Thus, the RTS packet that supposes send by node B can be suppressed. This mechanism continues to repeat at each intermediate hops till reaching the gateways.

PERFORMANCE RESULTS

Figure 8 depicts the variation of throughput as a function of payload for various MAC protocols. We can observe that the proposed protocol outperforms IEEE 802.11, MARCH and MACA-P protocols. The larger packet scenario is considered at the first hop. Since MACA-P was designed with concentric ring topology in mind, it suffers throughput degradation when applied for suggested topology as shown in Figure 4. This is due to the scheduling of infeasible concurrent transmission at intermediate nodes causing a lot of time wasted idling. Also, we observe in the Figure 8 that the other two protocols, MARCH have gained higher throughput over MACA-P protocol. Perhaps this observation is due to the smaller total delay per payload. Moreover the proposed protocol outperforms the other protocols especially when the larger payload size is considered as shown in Figure 8. Obviously this observation shows that the proposed protocol reducing the delay caused by the exposed node phenomenon at the first hop and reducing the delay caused by idling at intermediate mesh nodes significantly.

CONCLUSION

By presenting several serious problems encountered in an IEEE 802.11-based multi-hop network and revealing the underlying causes of them, we conclude that the current version of this wireless LAN protocol does not function well in multi-hop WMNs. We also indicate the specific problems existing in this protocol when it is used in a multi-hop network. Based on this analysis, we point out the potential direction to resolve those problems. This work identifies the limitation of 802.11 for

supporting concurrent transmissions. This is mainly due to the fact that 802.11 do not have any information about the ongoing transmissions in its neighborhood. The lack of overlapping transmissions was responsible for the "Exposed Node" problem which led to degradation in throughput due to insufficient channel utilization. We propose a set of enhancement to the existing IEEE 802.11 DCF MAC by enabling concurrent transmission by the exposed nodes and reduce the amount of signaling packets required at every hop until the data packet reaches its destination. Analytical models are developed and the multi-hop mesh network performances are evaluated in terms of overall throughput and delay. We have shown that proposed protocol outperforms the existing IEEE DCF MAC in throughput of multi-hop WMN.

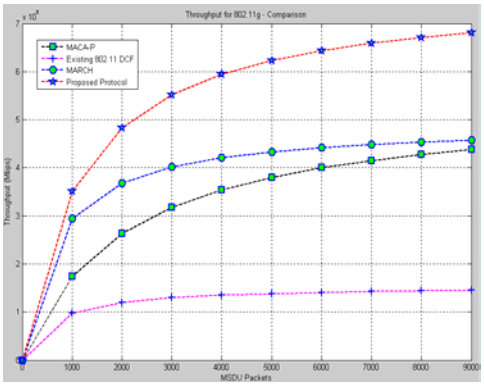


Fig.8: Throughput vs. payload size

ACKNOWLEDGMENT

The authors would like to take this opportunity to thanks those who are contributes directly or indirectly in completion of this article and also for their constructive comments.

REFERENCES

[1] I. Akyildiz and X. Wang, "A survey on wireless mesh networks," IEEE Communications Magazine, vol. 43, pp. 23–30, Sept. 2005.

[2] I. F. Akyildiz, X. Wang and Weilin Wang, "Wireless Mesh Networks: A Survey", Computer Networks Journal, 2005.

[3] J. Jun, P. Peddabachagari, and M. Sichitiu, "Theoretical maximum throughput of ieee 802.11 and its applications," in The 2nd IEEE International Symposium on Network Computing and Applications NCA, Apr.2003.

[4] A. Acharya, A. Misra, and S. Bansal, "Design and analysis of a cooperative medium access scheme for wireless mesh networks," in Proc. Intl. Conf. Broadband Netw. (BroadNets), San Jose, CA, Oct. 2004.

[5] A. Acharya, A. Misra and S. Bansal, MACA-P: A MAC for Concurrent Transmissions in Multi-hop Wireless Networks, IEEE Percom 2003.

[6] D. Shukla, L. Chandran-Wadia, S. Iyer, "Mitigating the exposed node problem in IEEE 802.11 adhoc networks", IEEE ICCCN 2003, Dallas, Oct 2003.

[7] C.-K. Toh, Vasos Vassiliou, Guillermo Guichal, and C.-H. Shih, "MARCH: A Medium Access Control Protocol for Multihop Wireless Ad Hoc Networks," in Proceedings of IEEE Military Communication, October 2000.

[8] S. Xuand T. Saadawi, "Does the IEEE 802.11 MAC protocol work well in multihop wireless ad hoc networks?," IEEE Commun. Mag., vol. 39, pp. 130–137, Mar. 2001.

[9] ANSI/IEEE, "802.11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications," 2003.

[10] A. Iyer and C. Rosenberg, "Understanding the key performance issues with MAC protocols for multi-hop wireless networks", Journal on Wireless Communications and Mobile Computing 6, pages 745–760, 2006.

An Overview of a Pi-Sigma Neural Network for Flood Prediction

Noor Aida Husaini[1,*], Rozaida Ghazali[1], Nazri Mohd Nawi[1], and Lokman Hakim Ismail[2]
[1]Faculty of Computer Science and Information Technology, Universiti Tun Hussein Onn Malaysia (UTHM), 86400 Parit Raja, Batu Pahat, Johore
[2] Faculty of Civil and Environmental Engineering, Universiti Tun Hussein Onn Malaysia (UTHM), 86400 Parit Raja, Batu Pahat, Johore
*gi090003@siswa.uthm.edu.my

Abstract
Malaysia experienced severe northwest monsoon floods in the state of Pahang and Johore in December 2006, which have flooded hundreds of towns and villages, killing a number of people and displacing more than 60,000 people. Those areas experienced the heaviest rainfall encountered over the past 100 years which lies below the normal fluctuations in rainfall patterns. Giving these scenarios, plans and efforts must be commenced to break the current disaster event. Flood forecasting undoubtedly is the most challenging task in operational hydrology. Conventional and statistical techniques for flood forecasting are sophisticated and extremely complex due to complex nature of hydroclimatological processes which make them less desirable for some applications. In this respect, Neural Networks (NN) have placed such sophisticated models within the reach of practitioners, and therefore have been successfully applied in many problems in hydrological prediction tasks. However, ordinary NN adopts computationally intensive training algorithms and can easily get stuck in local minima. To overcome such time-consuming operations in ordinary NN, this research examined a method which enables the construction of flood forecasting models to be more accurate and faster by using a Pi-Sigma Neural Network (PSNN). PSNN which has a single layer of tuneable weights can help speeding up the training process. The network will be used to learn the hydroclimatology data in the Batu Pahat, to predict the upcoming trends of the next-day and next-7-days rainfall distribution. Results from the predictions will be used to identify storm water event and as precautionary measures for flood forecasting.

Keywords
Pi-Sigma Neural Network, Flood Prediction.

INTRODUCTION

Flood is one of the annual events in Malaysia, which comes across two monsoon seasons a year. In December 2006, Malaysia experienced severe northwest monsoon floods in the state of Pahang and Johore [1]. Those area have suffered flooding disasters due to the widespread heavy rainfall episodes [1] and above average rainfall that caused by Typhoon Utor [2]. Out of 31 monitoring stations in Johore which 24 recorded as "very heavy" rainfalls of more than 60 millimeters [3] and the highest rainfall of 289 millimeters was recorded in Johore Bahru. The second wave of the flood, which was larger than the first wave, had almost paralysed Johore after all 8 districts including Batu Pahat were terrifically plunged by the flood [3]. Both waves of the flood disaster were considered as heaviest rainfall had encountered over the past 100 years which lies below the normal fluctuations in rainfall patterns.

Due to the current events, rainfall is said to be the main factors that contributes to the heavy floods near continuous nature of the rainfall [4]. In many engineering problems, such as flood forecasting, the prediction is critically important for a wise and sustainable use. For that reason, it is necessary to set up a method which enables immediate and well-organised construction of flood forecasting tool, which can contribute to immediate forecasting and disaster relief. A comparative study in flood forecasting has been applied to provide forecasters with information and techniques for flood prediction; basically using extremely complex mathematical models and linear statistical techniques. Among them are NAM-S11 mathematical modelling system to forecast the streamflow by Jønch-Clausen and Refsgaard [5], and ARIMA techniques and autoregressive for lake level forecasting and prediction of rainfall, by Guldal and Tongal [6] and Somvanhi [7], respectively.

Nevertheless, currently, it is still far from being satisfactory, most due to inaccurate initial conditions and limited spatial resolution. On the other hand, NN technique has been frequently used for forecast, recognition and classification purposes of many weather events [8], [9]. NN intends to explore the substantial parallel network of simple elements in order to yield results in a very short time period, and can overcome the limitations of the existing flood forecasting models. However, the ordinary NN often stuck in local minima and consume more training time on the computation of constrained conditions in the algorithm [9]. In addition, multilayer perceptron (MLP) which is an ordinary NN, have problems in dealing with large amounts of training data, while demonstrating poor interpolation properties [10], especially when dealing with hydrological time series, such as the rainfall time series. As a result, in this research, we propose the use of Pi-Sigma Neural

Network (PSNN) for the prediction of flood disaster in Batu Pahat for short and long term prediction; for real-time reservoir operation and distributing water for irrigation and mitigating drought, respectively. The equivalence of PSNN models is said to be simple in the architecture and has much fewer numbers of tuneable weights when compared to the standard MLP, therefore leads to a fast learning ability. Thus, the uses of PSNN in flood forecasting parallel these efforts.

PREVIOUS WORKS

In recent years, various flood forecasting models have been developed, which broadly can be classified into physically based processes and stochastically based approaches. Traditionally, the stochastically based approach for flood forecasting has been tackled by using linear technique; autoregressive (AR), autoregressive moving average exogenous (ARMAX) and also non-linear regression [5], [6], [7]. Therefore, this section provides several techniques and application regarding hydrological events.

Another application was described by Chang et al. [11] using Multi-Step-Ahead (MSA) neural networks for flood forecasting. The results indicate consistency in those three approaches: Multi-Input-Multi-Output (MIMO), Multi-Input-Single-Output (MISO) and serial-propagated structure. Serial-propagated structure shows compromising result with MSA forecasting. The major differences between serial-propagated of both techniques, MIMO and MISO; is the use of predictive output as additional inputs so that a number of suitable structures that could fit the training input-output data well can easily be found. However, since the performances of the models are rapidly decreased, the networks are unnecessary for validation and/or testing set especially when dealing with real time data [11].

Nasseri et al. [12] use a hydridisation of BPNN and genetic algorithm (GA) to forecast rainfall by using rainfall hyetograph in the Upper Parramatta River catchments, Australia. From the result, it shows that by coupling both NN and GA consistently performed better rather than ordinary NN by itself. However, since the effectiveness of input for those discrete data in input stations decreases over the time, it is advisable to use cumulative data to achieve better statistical performance in rainfall prediction [12]. Studies related to daily rainfall prediction have been conducted in Timika, south Papua Island using multivariable Adaptive Neuro Fuzzy Inference System (ANFIS) [13] and hindcast method to validate the historical data of daily rainfall distribution. The network performance was compared to several surface parameters: precipitation amount, relative humidity, temperature and surface pressure. Relative humidity shows the best predictor for rainfall event. However, it is suggested to use a transforming function on different predictor so that the magnitude of some parameter can be equally in the same range. It is because; ANFIS is sensitive and cannot works well when dealing with parameters that have different magnitudes and scale size [13].

Apart from that, Bambang Widjanarko Otok and Suhartono [14] use different method for rainfall prediction at three different location: Ngale, Karangjati and Mantingan. They compare the three approaches: ASTAR, ARIMA and Transfer Function methods. Based on the three models, Multi-Input Transfer Function model is the best model in Ngale and Karangjati while ASTAR with two interactions is the best model for Mantingan region. For augmentation, it is suggested to contribute more input variables in Multi-Input Transfer Function model in order to improve the accuracy of the forecast model [14]. Hung et al. [15] employed an NN model using 4 years of hourly data from 75 rain gauge models for real time rainfall forecasting and flood management in Bangkok. The NN model is using hyperbolic tangent function in order to achieve the generalisation. They consider multivariate data; relative humidity, air pressure, wet bulb temperature, and cloudiness, in additional with the rainfall distribution as input data. The result shows comprising result especially with the use of auxiliary data which improve the forecasting in terms of accuracy and efficiency. Nevertheless, the most important part is to pick the leading model inputs so that it can increase the generalisation of the network. It is however, still, the efficiency indices is said to be gradually reduced as the forecast lead time increased from 4 to 6 hour [15].

Seasonal Rainfall Forecasting was evaluated by Fallah-Ghalhary et al. [16] for the rainfall distribution of Khorasan Province, Iran by using regression model. A diagnostic tool to derive anomalous rainfall atmospheric patterns characteristic and to derive seasonal rainfall at the area and local scales was used at the first step. It is followed by the statistical methods to discover pattern between the correlation rainfall and climate signals that characterised the seasonal atmospheric circulation and the atmospheric control fields. Tangent hyperbolic function and linear tangent hyperbolic function were used in the hidden layer and output layer, respectively. The result shows that the performance of NN was superior to the other model for rainfall prediction. Considering of those predictors, future political of maximum operation should be planned [16].

DATA DESCRIPTION

In this paper, we described the use of PSNN for a short and long terms prediction. Data obtained at Central Forecast Office, Malaysian Meteorological Department. The predictive variable is the rainfall distribution; consists of 5 years rainfall historical data of Batu Pahat district; ranging from 2005 to 2009. In this case, the selection of NN input variables are generally based on priori knowledge of the problem

under consideration. Therefore, we use trial-and error procedure with input variables between 4 to 8. As the main target is to predict the upcoming amounts of rainfall, the number of output node is set to one. The data then will be normalised and scaled between the upper and lower bounds of the network's transfer function which is between $[0,1]$. After normalisation procedure, the rainfall data will be divided into three independent subsets; 50% training, 25% testing and another percent for validation. The error on the validation set is monitored during the training process. The validation error normally decreases during the initial phase of training, as does the training set error. Nevertheless, as the network begins to overfit the data, the error on the validation set will slightly begin to rise. When the validation error increases for a specified number of times, the training of the network is stopped, the minimum weights of the validation error are stored for generalisation purpose [8].

MODEL DESCRIPTION

Pi-Sigma Neural Network (PSNN), which was introduced by Shin and Ghosh [17], is a multilayer higher order neural network (HONN) that consists of a single layer of trainable weights. Figure 1 shows the architecture of k-th Order PSNN which consists of two layers; the product unit and the summing unit layers.

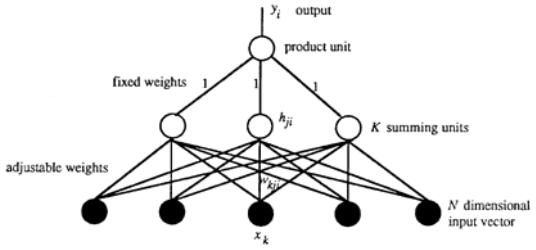


Figure 1: Structure of k-th Order PSNN

Input x is an N dimensional vector and x_k is the k-th component of x. The weighted inputs are fed to a layer of K linear summing units; h_{ji} is the output if the j-th summing units for the i-th output y_i, viz:

$$h_{ji} = \sum_k w_{kji} x_k + \theta_{ji}, \quad \text{and} \quad y_i = \sigma\left(\prod_j h_{ji}\right), \tag{1}$$

where w_{kji} and θ_{ji} are adjustable coefficients, and $f(x)$ is the nonlinear transfer function [17]. Weights from hidden layer to the output layer are fixed to unity, resulting to a reduction in the number of learnable weights. Hence, it can reduce the training time.

Sigmoid and linear functions are adopted in the summing layer and output layer, respectively. The use of linear summing units at the output layer makes the convergence analysis of the learning rules for the PSNN more accurate and tractable [10]. The number of the summing units in PSNN reflects the network order. By using an additional summing unit, it will increase the network's order by 1. The higher order terms of PSNN in this research is set between 2 and 5. The applicability of this network was investigated by Zhang [9] and Shin et al. [18] for shift, scale and rotation invariant pattern recognition.

Compared to other HONN, Shin and Ghosh [17] argued that the PSNN can contribute to maintain the high learning capabilities of HONN, require less memory in terms of weights and nodes, and at least two orders of magnitude less number of computations when compared to MLP for similar performance levels, and over a broad class of problems [10]. The weights of PSNN will be initialised randomly in the range of $[0,1]$ and evaluation of the network performance will be made using Normalised Mean Squared Error (NMSE), for measuring bias and scatter. Obviously, the smaller NMSE value, the better is the performance [19]. The momentum term, α and the learning rate η is added for dampening oscillations and to avoid the network from stuck in a shallow local minimum [19].

LEARNING ALGORITHM

The derivation of dynamic learning algorithm for the MLP and PSNN is trained using gradient descent procedure by exploring backpropagation (BP) algorithm on estimated mean squared error (MSE). The foundations of the BP method for learning in NN where laid by Rumelhart et al. [20]. Training is usually carried out by iteratively updating the weights based on the error signal, which is based on Widrow-Hoff delta learning rule. The set of the sample patterns are repeatedly presented to the network until the error value is minimised [21].

There are two different ways in which this gradient descent algorithm can be implemented: incremental mode and batch mode [8]. In this study, we are using incremental mode since it uses real time data. In incremental mode, the gradients are computed and the weights are incrementally adjusted between $[0,1]$ for the reduction of the network's output error [21]. The commonly used MSE function propagates the error gradient back through the weights and nonlinear function in the processing units, using chain rule. The range of the sigmoid activation function is between $[0,1]$ which can only be reached asymptotically. The calculated gradients at each training example are added together to determine the change in the weights and biases [8]. The weights and biases are updated in the direction of the negative gradient of the performance function by multiplying the learning rate, η with the negative of the gradient.

DISCUSSION AND CONCLUSION

This paper described an overview of a neural network-based flood forecasting in Batu Pahat area. From the weather forecasting view, the continuous

nature of the rainfall always be the most critical factor [4]. Prior to computation, pre-processing always play an important procedures in dealing with rainfall distributions. In this work, a PSNN was chosen to be the solution in dealing with flood problems for modelling the nonlinear rainfall time series signals. As PSNN are able to learn in a stable manner even with fairly learning rates, the use of linear summing units makes the convergence analysis of the learning rules more accurate and tractable [12]. Making the process of flood prediction more precise and well-mannered will surely give more value to flood warnings and reduce the number of unpredicted flood events in the future.

ACKNOWLEDGMENTS

The authors would like to thank **Universiti Tun Hussein Onn Malaysia** for supporting this research under the Postgraduate Incentive Research Grant.

REFERENCES

[1] Bloomberg. "Floods Force 22,740 People to Leave Homes (Update1)." [http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aS5Yewd0psRo&refer=asia]. 2006.

[2] thestaronline. "Typhoon Utor to Blame." [http://thestar.com.my/news/story.asp?file=/2006/12/21/nation/16380186&sec=nation]. 2006.

[3] Department of Irrigation and Drainage, "Stormwater Management." [http://www.water.gov.my/]. 2009.

[4] Johnson, G. P., Holmes, R.R., Jr., and Waite, L. A., The Great Flood of 1993 on the Upper Mississippi River—10 Years Later, *U.S. Geological Survey,* (2003), 1-4.

[5] Jønch-Clausen, T. and Refsgaard J.Ch., A Mathematical Modelling System for Flood Forecasting, *Nordic Hydrological Conference, Denmark.* 15(1984), 307-318.

[6] Güldal, V. and Tongal, H., Comparison of Recurrent Neural Network, Adaptive Neuro-Fuzzy Inference System and Stochastic Models in Eğirdir Lake Level Forecasting, *Water Resour Manage,* 24(2010), 105-108.

[7] Somvanhi, V. K., Pandey, O. P., Agrawal, P. K., Kalanker, N. V., Prakash, M. R., and Chand, R., Modelling and Prediction of Rainfall using Artificial Neural Network and ARIMA Techniques, *J. Ind. Geophys. Union.* 10(2), (2006), 141-151.

[8] The MathWorks. "Neural Network Toolbox." [http://www.mathworks.com/access/helpdesk/help/toolbox/nnet/index.html?/access/helpdesk/help/toolbox/nnet/backprop.html&http://www.google.com.my/search?q= backpropagation&ie=utf-8&oe=utf-8&aq=t&rls=com. google:en-US: official& client=firefox-a]. 2009.

[9] Zhang, M. *Artificial Higher Order Neural Networks for Economics and Business,* USA: Information Science Reference, (2009).

[10] Ghazali, R., Hussain, A., and El-Dereby, W., Application of Ridge Polynomial Neural Networks to Financial Time Series Prediction, *International Joint Conference on Neural Networks (IJCNN '06),* (2006), 913-920.

[11] Chang, F. J., Chiang, Y. M., and Chang, L. C., Multi Step-Ahead Neural Networks for Flood Forecasting, *Hydrological Sciences-Journal-des Sciences Hydrologiques.* 52(1), (2007), 114-130.

[12] Nasseri, M., Asghari, K., and Abedini, M. J., Optimized Scenario for Rainfall Forecasting using Genetic Algorithm Coupled with Artificial Neural Network, *Expert Systems with Applications,* 35(2008), 1415-1421.

[13] Aldrian, E. and Yudha Setiawan Djamil, Application of Multivariate ANFIS for Daily Rainfall Prediction: Influences of Training Data Size, *Jurnal Makara Seri Sains, Universitas Indonesia,* 1(2008), 7-14.

[14] Bambang Widjanarko Otok and Suhartono, Development of Rainfall Forecasting Model in Indonesia by using ASTAR, Transfer Function, and ARIMA Methods, *European Journal of Scientific Researc,* 38(3), (2009), 386-395.

[15] Hung, N. Q., Babel, M. S., Weesakul, S., and Tripathi, N. K., An Artificial Neural Network Model for Rainfall Forecasting in Bangkok, Thailand, *Hydrology and Earth System Sciences,* 13(2009), 1413-1425.

[16] Fallah-Ghalhary, G. A., Mousavi-Baygi, M., and Habibi-Nokhandan, M., Seasonal Rainfall Forecasting using Artificial Neural Network, *Journal of Applied Sciences,* 9(6), (2009), 1098-1105.

[17] Shin, Y. and Ghosh, J., The Pi-Sigma Networks: An Efficient Higher-Order Neural Network for Pattern Classification and Function Approximation, *Proceedings of International Joint Conference on Neural Networks,* 1(1991-b), 13-18.

[18] Shin, Y., Ghosh, J. and Samani, D., Computationally Efficient Invariant Pattern Recognition with Higher Order Pi-Sigma Networks, *Intelligent Engineering Systems through Artificial Neural Networks-II,* (1992), 379-384.

[19] Rojas, R., *The Backpropagation Algorithm, Neural Networks,* Berlin: Springer-Verlag, (1996).

[20] Rumelhart, D. E., Hinton, G. E., and Williams, R. J., Learning Representations by Back-Propagating Errors, *Nature,* 323(9), (1986), 533-536.

[21] Kawaguchi, K. "Backpropagation Learning Algorithm." [http://www.ece.utep.edu/research/webfuzzy/docs/kk-thesis/kk-thesis-html/node22.html]. 2000.

A Study of Measurements and Prediction Models For Signal Propagation through Vegetation Microwave Frequencies

Mahmoud Elshayeb. Prof. Ir. Dr. Ahmad Faizal Mohd Zain and Dr. Jiwa bin Abdulla
Faculty of Electrical & Electronic Engineering, UTHM
86400 Parit Raja, batu Pahat, Johor
Email:elshayebmahmoud@yahoo.com

Abstract

The effects of vegetation media on the planning and design of radio links at microwave and millimetre wave frequencies are considerable and must be accounted for by radio system operators and users. This paper presents a study of propagation models for the excess attenuation of signals caused by such media whose mathematical descriptions have been optimized using measured data. This paper shows that one of the models which expresses the attenuation as a function of frequency and depth of vegetation gives close predictions for the two broad generic cases of trees 'in-leaf and 'out-of leaf . Measurements have been made to determine the extent of attenuation of millimeter-wave signals when propagated through vegetation. Methods for predicting such attenuation exist, but are either deterministic in form or therefore complex to implement or are completely empirical and take no account of measurement geometry. A new semi-empirical model is presented here which is based on measurements of vegetation attenuation presented previously, and has some account of the measurement geometry. This model is compared with measured data and is shown to give considerably better agreement.

Keywords

Vegetation, propagation, microwave, prediction

INTRODUCTION

Wireless links are revolutionizing personal and telecommunication services with overall growth in satellite communication markets. Increased capacities and wider bandwidths require system designers to consider frequencies at higher bands e.g. microwave and mill metric frequencies. Analytical studies based on experimental measurements showed that the effects of trees singly or as a group in the radio path of a point-to-point link influenced the received signal level. In this experiment we determine the amount of penetration at 11.2 GHZ at 11.2 GHZ the received signal was down converted to an IF of 1.2 GHZ .The IF frequency was monitored on a spectrum analyzer connected to computer to record the signal strength. The transmitters were placed at 11 m and 4 m height from tree .the receivers were mounted at a higher 4 m. Vertical polarization was used in dry weather with moderate wind .The signal Strength was recorded 60 times in the midway between the trees .the signal received is normalized to the signal level expected Previous modeling has suggested the form.

$$L = k\, d^{x} \quad (1)$$

Where L is loss in dB and d is the foliage depth in meters. K and x are parameters calculated to give good fit with the measured observations.

NON ZERO GRADIENT MODEL

The nonzero gradient model (NZG) goes some way towards this since it has parameters for the initial and final attenuation rates.

1 *(2)* Where R_0 is the initial attenuation rate, $R\infty$ is the final attenuation rate, k is a final attenuation offset and d is the depth of vegetation in meters

Table1. NZG model parameter values from measured data [3]

Model parameter	At 11.2 GHZ
R_0 [dB m]	5.67
R_∞ [dB m]	0.33
K [dB]	19.1

The maximum attenuation rate (MAR) model applies when the attenuation rate flattens out at larger depths of vegetation. This model is reduction of equation and given by:

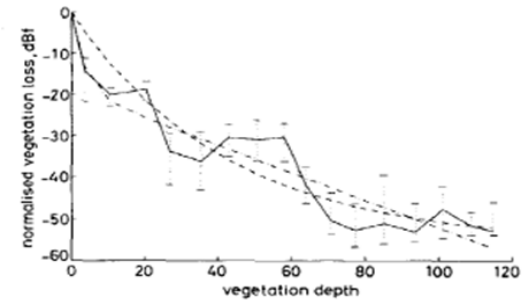
$$A = -(A_m (1 - \exp(-R_0 d / A_m))) \quad (3)$$

Where A_m is the maximum attenuation, R_0 is the initial attenuation rate and d is the vegetation depth. This values which obtained in this model using the measured data are shown in Table 2

Table2. MAR model parameters values from measured data [3].

Model parameter	At 11.2 GHZ
R_O [dB m]	1.43
A_m [dB]	55.55

From figure 1'. It can be seen that the NZG model give better fit than the MAR model The NZG model is more suited for vegetation media of relatively small depths. There is a pronounced difference between the modeled results at 11.2 GHZ. That shown in 'Figure 1



—— mean data ---- NZG model ----- MAR model

Figure 1 :Measured data and modelled curves at 11.2 GHz

This could be due to gaps caused by the absence of leaves and wind movement.More consistency is expected in the foliated state .The data has a mean variation of 8.5 dB over all variation depths.

The current ITU-R recommendation applicable at frequencies for the prediction of vegetation attenuation gives the attenuation in dB

$$A = 0.2\, f^{0.3}\, d^{0.6} \qquad (4)$$

This model was compared with the database of measurements for the case of vegetation in leaf and out of leaf.

When compared with the database of in-leaf measurements, the ITU-R gave б=22.1dB

The optimum fit to the data by change values 0.2 and 0.6. For the case of vegetation in leaf, the attenuation is given by:

$$A = 15.6\, f^{0.009}\, d^{0.26}\ \text{dB} \qquad (5)$$

Which gives a fit of б= 10.8 dB. For the case of out of leaf

$$A = 26.6\, f^{-0.2}\, d^{0.5}\ \text{dB} \qquad (6)$$

Which gives a fit of б =10.4 dB

Dual Gradient Model

The NZG model was further developed by researchers at RAL to accommodate the Difference in the received signal levels, when using antennas of different beam widths, resulting in the Dual Gradient (DG) model. In [Cost 235, 1996] and [Seville, 1997], The site geometry is taken into account, which considers the extent of illumination of the vegetation medium. This is characterized by the illumination width, *W*, the maximum effective coupling width resulting from the interaction between the Transmit and receive antenna beam widths inside the vegetation medium, as shown in Figure (2).

The DG model also includes the frequency of the propagation as a parameter and takes the form shown in Equation (7). However, this model gives a fit to individual data sets, and further scaling to measurement frequency and geometry is required. in order to account for the site geometry.

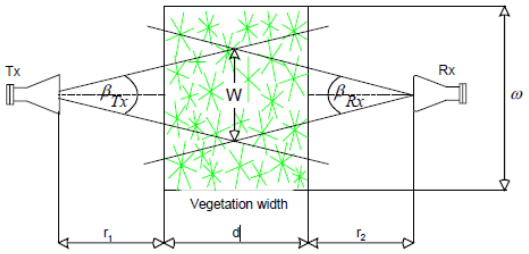


Figure 2.Vegetation measurements geometry [3].

$$L = \frac{R_\infty}{f^a W^b}\, d + \frac{k}{W^c}\left(1 - e^{\left(-\frac{(R_o - R_\infty)W^c}{k} d\right)}\right) \qquad (7)$$

Where a, b, c, k, R_O and R_∞ are constants described in [COST 235, 1996], [Seville, 1997], and given in Table 3.

Table3. Constant values of equation (7)

Constant parameter	In -leaf	Out-of-leaf
a	0.70	0.64
b	0.81	0.43
c	0.37	0.97
k	68.8	114.7
R_o	6.7	6.59
R_∞	8.77	3.89

$$W = \min\left[\begin{array}{c} \frac{(r_1 + d + r_2)\tan(\beta_{Tx})\tan(\beta_{Rx})}{\tan(\beta_{Tx}) + \tan(\beta_{Rx})} \\ (r_1 + d)\tan(\beta_{Tx}) \\ (d + r_2)\tan(\beta_{Rx}) \\ \omega \end{array}\right] \qquad (8)$$

The frequency f is given in GHz and W is the maximum effective coupling width between the two antennas and is defined by Equation (8)

The DG model expresses frequency dependence in its equation, which, unlike the NZG, seems to contradict that in the ITU-R models [Stephens, 1998].

The inverse relationship with frequency (f^a and a>0*)* suggests a decreasing attenuation as frequency increases, which appears to contradict both the anticipated behaviour and that observed in the measured data. Preliminary testing of this model by *Stephens* [Stephens, 1998] have revealed certain shortcomings and inaccuracies.

It was concluded that further work on this model is needed in order to eliminate these inconsistencies.

Discussion

A comparison was made of this dual gradient model (DG) with the database of measured data .for the in – leaf case, the new model gives a standard deviation fit

of б=8.4 dB and for the out of leaf case б=8.1 d B, which reduce by more than half the standard deviation given by ITU-R model.

Figure (3) shows comparison of the DG model with the data measured at 11.2 GHZ and two measurements sites for the in –leaf case

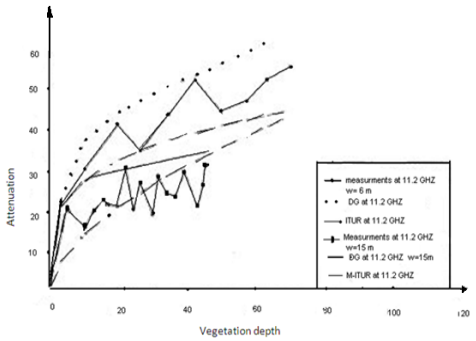


Figure 3: Comparison of vegetation attenuation models with measured data for 11.2 GHZ.

CONCLUSION

Prediction models expressing the excess attenuation of vegetation media as a function of frequency and path length and which do not require specific details of site geometry are highly desirable in the design and planning of radio systems. Such models have been described and their performance analyzed against measured data obtained at frequencies for both in-leaf and out-of-leaf states. Although this model was developed by optimizing its parameters with respect to measured data, site dependence was minimized by using measured data from a number of sites having different path geometries and tree types. As a result, two functions are defined corresponding to the two broad generic cases of in-leaf and out-of-leaf. The role of measurement data in the development of vegetation attenuation and scatter models is very important and further work is required in order that future models account for effects resulting from the specific characteristics of the vegetation site. This does not detract from the value of simplified models Such as the FITU-R and NZG, which are particularly important where site specific information is either missing or costly to obtain. Such models have been described and their performance analyzed against measured data obtained at frequencies for both in-leaf and out-of-leaf states. Although this model was developed by optimizing its parameters with respect to measured data, site dependence was minimized by using measured data from a number of sites having different path geometries and tree types. Disadvantages of these models stem from their limited applicability because in their formulation and validation, they were based on a limited number of site geometries and relatively few measurements.

As a result, two functions are defined corresponding to the two broad generic cases of in-leaf and out-of-leaf. The role of measurement data in the development of vegetation attenuation and scatter models is very important and further work is required in order that future models account for effects resulting from the specific characteristics of the vegetation site.

ACKNOWLEDGMENTS

The authors would like to thank UniversitiTun Hussein Onn Malaysia (UTHM) for providing the funding for the Wireless and Radio Science (WARAS) Centre. WARAS operates the first and only digital ionosonde in Malaysia.

REFERENCES

[1] M.O.Al-Nuaimi and A.M.Hammoudeh “Attenuation functions of microwave signals propagated through trees”, Electronic Letters, 29, (14), pp. 1307-1308, 1993a.

[2] M.O.Al-Nuaimi and A.M.Hammoudeh 'Influence of Vegetation on Attenuation of Radio wave Signals in the X-Band Frequency Region', COST 235 TD, CP 149, June 1993b.

[3] M.O.Al-Nuaimi and A.M.Hammoudeh "Measurements and Predictions of Attenuation and Scatter of Microwave Signals by Trees", IEE Proceeding on Antennas and Propagation, Part H, Vol. 141, No. 2, 1994a.

[4] M.O.Al-Nuaimi and A.M.Hammoudeh “Measurements and Predictions of Attenuation and Scatter of Microwave Signals by Trees”, IEE Proc Microwave Antennas Propagation. Vol. 141, No. 2, April 1994b.

[6] M.O. AL-NUAIMIand R. STEPHENS, “Measurements and prediction model Optimization for signal attenuation in vegetation media at centimetre wave frequencies” IEE Proceedings on Microwave Antennas and Propagation, Vol. 145, No 3, June 1998.

[7] R. F. S. CALDEIRINHA, “Radio Characterization of Single Trees at Micro- and Millimetres Wave Frequencies”, PhD thesis, University of Glam organ, 2001.

[8] R. CALDEIRINHA and M. AL-NUAIMI, "Co-Polar and Cross-Polar Measurements of the Re-Radiation Signal at 20 GHz from a Tree and their Analysis in the region around the Page 122 of 134 QINETIQ/KI/COM/CR020196/1.0 Nulls", IEEE Proceedings of the Sixteenth National Radio Science Conference, Ain Shams University, Cairo, Egypt, INV4, Feb. 23-25, 1999.

[9] R. CALDEIRINHA and M. AL-NUAIMI, : "Analysis of the Re-radiation Functions of Single Trees and Idealized Structures at 20 GHz", AP2000 Millennium Conference on Antennas & Propagation, Davis, Switzerland, Pap. 460, April 11-15

HCI Models: *An Overview*

S. F. Ismail[1,*], R. Hashim[1] and S.Z.Z. Abidin[2]
[1]*Faculty of Information, Technology and Multimedia,Universiti Tun Hussein Onn, Malaysia, Johor, Malaysia*
[2] *Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA,* Selangor, Malaysia
*gi090009@siswa.uthm.edu.my

Abstract
The existence of Human Computer Interaction (HCI) models that help in terms of User Interface (UI) designation and evaluation should be selected conscientiously. Therefore, in this paper we have made a critical review of HCI models and grouped them based on their types of the model such as UI concept, design and development and task analysis. Besides helping designers to choose the model that fits the criteria of their desired UI, the classification of those HCI models also can assist them to apply HCI rules and design good accessibility features of UI. Furthermore, this review serves as an initial effort towards developing a new HCI model that can be applied to any collaborative medium or products.

INTRODUCTION

User Interface (UI) or simply interface plays role as a medium for user performing their task where it's facilitating interaction between users and computers. The interaction can be seen when humans or users manipulate a system or device through input and output which enable users to see the result from the activity. The system's functionality will support user tasks to perform it easily but they will face with trouble in accomplishing the task if the interface is not well designed [1]. Thus, to get increase the effective of interaction, interface applicability and usability need to be enhanced. By applying visual element such as icon, button, and different layout style make ease of interface to be learned [2] by users to perform their task.

The organisation of this paper is as follows. First, in the remainder of this introduction, we discuss the evolution and significant of HCI field on human and computer. Section II describes related work and the types of HCI model in Section III. Section IV describes the analysis of the usability, effectiveness and complexity of the models and Section V offers conclusions.

RELATED WORK

User Interface

The Graphic User Interface (GUI) has evolved for more than 20 years from a static green or black screen using a prompt line as input medium to interactive iconic animation or virtual realistic environment. The interface that we see today is very much contributed by what had been developed by the HCI researches rooted in the universities [3, 4]. The use of visual design elements such as button, icon and different layout style help a system to be learnable, efficient, simple and well-structured [2].

Human Computer Interaction

HCI is a discipline about design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them [5]. In another definition of HCI is it is concerned with understanding how people make use of devices and systems that incorporate or embed computation, and how such devices and systems can be more useful and more usable [6].

HCI Model

HCI model can be considered as a model that useful if it helps in designing, evaluating, or otherwise providing a basis for understanding the behavior [7] of interaction between humans and computers.

TYPES OF HCI MODEL

Psychological Model of UI

Cognitive Model

This model depicted of human cognitive process to predict and comprehend something. Until today, there a few technologies that uses theory of cognitive to create interfaces such as toolkit and User Interface Management System (UIMS) [8].

Mental Model

Mental model can be constructed from perception, imagination, or the comprehension of conversation to solving problems [9]. In 2003, Cooper and Reimann defined a user's mental model of software product is users perceive the jobs they want to do and how the program helps them to do it [10]. In HCI contexts, correct mental model are valuable to improve design and interface usability.

Conceptual Model

The difference of terms and concept between designers and users mental model would not occur because conceptual model is aimed to clarify those ambiguous. It will bring users satisfaction on the product because it draws on users past experiences and developers have

great control over, and the closer it matches the mental model of the user, the easier the user will find the program to use [10, 12].

Model for Design and Development of UI

Model of Structure-Behavior-Presentation

Model of structure-behavior-presentation encounters fundamentals of user interface. Basically web is representation of certain information or data which supported by words (structure), codes (behavior) and pictures (presentation) [7, 12]. It can be concluded that structure is consisting process of organization and optimization of content. Interaction between user and content such viewing and navigation of web page is taking place in behavior and presentation is visual presentation of content.

Universal Model

In 2002, Bob Baxley came out with universal model which it is an influential model of user interface design. According to Baxley (2002), "Universal model is a model of a user interface that can be applied to any interactive medium or product. The model begins with on the established model of structure-behavior-presentation but adds additional levels of granularity and specificity." [3, 11].

A Model-based Interface Development Environment

In 1997, Angel Puerta has succeeded invent a Model-based Interface Development (Mobi-D) as a new environment for model-based interface development. This comprehensive environment supports user-centered design through model based interface which all different models such user-task model, dialog model and presentation model. [13]. Despite that, there are two deficiencies of Mobi-D. First, user are required to perceive and comprehend the abstract models and languages and the second one is new application has to be generated again if any modification required. Thus, it shows they only work from model to the generated application.

HCI Model: Synthetic and Analytic Methods

Tokuda *et. al* [14] have proposed a new HCI model that is suitable for practical synthetic and analytic activities of UI design. This model consist of three layers such semantics, syntax and action which each layer point to practical and important concepts in the activities. In synthetic method it is involving three steps: UI function definition, interaction method definition and action flow definition. Whilst three steps also including in analytic method which is goal definition, proposed GOMS-based analytic specification (GAS) in order to analyze each goal by using GOMS method and evaluation factors (semantic affordance, syntactic affordance and action affordance) are taking place in the last step. In this step, all user activities in GAS hierarchy are evaluated to make the UI designed usability much better. [8].

Model of Task Analysis

Card, Moran and Newell (1983) developed the Goals, Operators, Methods and Selection rules (GOMS) model for analyzing routine human computer interactions. This model is expanded to several variations for certain interfaces [6, 15, 16] such as:

- Key-Stroke Level Model [6]
- Card, Moran and Newell GOMS (CMN-GOMS) Model [6]
- Natural GOMS Language (NGOMSL) Model [6, 16]
- Critical Path Method or Cognitive, Perceptual and Motor GOMS (CPM-GOMS) Model [6, 16]

ANALYSIS

This section discusses different categories for comparative analysis of HCI model that was stated in section III. The categories are as follows:

- Complexity: Difficulty that bring problems whilst user perform task.
- Usability: The ease with which designer can employ a model.
- Effectiveness: The capability of model in producing an effect.

This comparative analysis is performed in order to evaluate the models based on the categories above. However, Table 1 does not compared in terms of complexity since the three models are complementing each other.

Table 1: Comparative analysis between psychological models of user interface

Models	Usability	Effectiveness
Cognitive Model	• To predict and comprehend human cognitive process. • Predict human performance.	• Assisting user and • Simulate human behavior.
Mental Model	• To predict events or psychological.	• Assisted in decision making application. • Improve design and interface usability.
Conceptual Model	• Clarify the ambiguous of terms and concept of designers and users mental model.	• User's satisfaction on the product.

Referring to Table 1, it is plain to see that the three models are interrelated each other as a starting point to produce an interface. These models are very closely related with user cognitive because user experiences are needed in order to clarify the interface criteria. It is starts with cognitive model that can understand user's cognitive processes and also can predict time that

taken by user to carry some task. Then, mental model is about user's thinking and how their imagination is realized. This model can helps designer produce a product that can help in decision making. However mental model of users and designers is different. Thus, conceptual model existed to explain all ambiguities between these two mental models. This model is very popular because of its significant in building effective of user interface usability.

Table 2: Comparative analysis between models for the design and development of user interface.

Models	Complexity	Usability	Effectiveness
Model of Structure-Behavior-Presentation	• No details level of structure, behavior and presentation. • Only designer understand the process. • Might be miscommunication. • Not support user-centered design.	• Consist fundamentals of user interface.	• Supported by words (structure), codes (behavior) and pictures (presentation).
Universal Model	No complexity	• Adds additional levels of granularity and specificity. • Communication device • Diagnostic tool. • Can be applied to any interactive medium or product.	• Understandable by designer and non-designer.
A Model-based Interface Development Environment	• User required perceiving and comprehending the abstract models and languages. • Only work from model to the generated application.	• 3 key innovation. • Declarative model. • A set of software tools - interactive development tools, automated development tools and runtime tools.	• User-centered design • Clear communication between user and developer. • Comprehensive environment. • Supports user-centered design through model based interface.
HCI Model: Synthetic and Analytic Methods	• Not user-centered design. • Only work one way: from model to generated system.	• Evaluation factors to make usability of UIs. • Consist of three layers that point to practical and important concepts in the synthetic and analytic activities. • Proposed specific synthetic and analytic method for UI interaction design.	• Enhance usability of UIs.

Referring to Table 2, Model of User-Behavior-Presentation and HCI Model: Synthetic and Analytic Methods are not to concerned about user-centered design (UCD) whereas UCD is a philosophy that encompasses of user, user task and goal where it place on users in the middle of interface development process. It is also process that focused in cognitive factors such as perception, memory and so on. Although Mobi-D is concerned about UCD, it puts user in heavy situation since user has to understand overall abstract models and languages. The complexity that should be emphasized is models that work at only one way. There is no phase that allowing repetition if mistakes occur during interface development process. However for Universal Model, it has no complexity and it can be applied to any interactive medium or product.

Table 3: Comparative analysis between models of task analysis of user interface.

Models	Complexity	Usability	Effectiveness
GOMS Model	• The tasks are only valid performed by an expert user.	• Various qualitative and quantitative measures. • The model explains why the results are, what they are and so on. • Functionality coverage output.	• Helps the software designer to model user behavior and be a method that describes the task
Key-Stroke Level Model	• On low level task and focused on unit task. • Needs explication in term of the absence of error.	• Communication device. • Diagnostic tool. • Provide rapid estimates of user performance.	• Simplify the version of GOMS. • Simple technique to rapid estimate of execution time. • Most practical model because it can be simply to apply and justify to computer-software developers.
Card, Moran and Newell GOMS (CMN-GOMS)	• Rigid structure that was builds on KLM.	• Predict operator sequence and provide task execution time. • Focus attention on methods to accomplish goals.	• Give the task situation. • Predict the selection of goal and method.
Natural GOMS Language (NGOMSL)	• No multitasking because of serial operation.	• Have certain properties by adding cognitive complexity theory (CCT) that makes it more unique.	• Enhance usability of UIs. • Estimate time and estimate execution time. • Regularized level of detail and the formal syntax.
Critical Path Method or Cognitive , Perceptual and Motor GOMS (CPM-GOMS)	• Requires the evaluator • Most difficult GOMS technique to implement.	• Applied model human processor (MHP) to model parallel activities. • Critical path method plays as project planning technique.	• Facilitate representation of overlapping.

Referring to Table 3, all GOMS model above is aimed to predict time taken by user to carry their task. There are too simple model like KLM but there is also those are complicated and difficult to be utilized. However, every model has the advantages and suitable to apply according interfaces types.

CONCLUSIONS

As conclusions, this paper discuss comprehensively of HCI models in terms of complexity, usability and effectiveness. The comparative analysis between the models of interface concept depicts that all three models (Cognitive Model, Mental Model and Conceptual Model) are interrelated in order to develop interface design. Even though most of models for the design and development applied user-centered design, however they should be simple, understandable for user and not work at only one way. In terms of

evaluation task, designer should choose the best task analysis models that suitable to interface types. Therefore, this analysis will be an initial effort to develop a HCI model for collaborative applications.

ACKNOWLEDGMENTS

The authors would like to thank **Universiti Tun Hussein Onn Malaysia** for supporting this research under the Post Graduate Insentive Research Grant.

REFERENCES

[1] Dix, A., Finlay, J., Abowd, G. D. & Beale, R. "Human-Computer Interaction", 3 edn, Addison-Wesley Pearson Education, London, 2004, pp. 110.

[2] J. Fleming. (1998) Web Navigation: Designing the User Experience [Online] Available: http://oreilly.com/catalog/navigation/chapter/ch05.html,

[3] B. A. Mayers. http://www.cs.cmu.edu/~amulet/papers/uihistory.tr.html, January 2010.

[4] D. Norman, "The Design of Everyday Things." Basic Books, Inc., 1988.

[5] ACM SIGCHI, (1992). [Online]. Available: http://sigchi.org/cdg/cdg2.html

[6] Carroll, J.M. "HCI Models, Theories and Framework." Morgan Kaufmann Publishers, San Francisco, 2003.

[7] MacKenzie, I.S. "Motor behavior models for human-computer interaction." In J. M. Carroll (Ed.) *HCI models, theories, and frameworks: Toward a multidisciplinary science,* (2003), pp. 27-54. San Francisco: Morgan Kaufmann.

[8] Brad A. Myers "A Brief History of Human Computer Interaction Technology", 1996.

[9] J.D. Mary, D. Laura, W. Julie (1999, November 15). Mental Models and Usability [Online]. Available: http://www.lauradove.info/reports/mental%20models.htm

[10] Cooper, A. & Reimann, R. *About Face 2.0: The Essentials of Interaction Design*, Wiley Publishing Inc, Indianapolis, 2003.

[11] Bob Baxley, "Universal model of a user interface." In Proceedings of the 2003 conference on Designing for user experiences, 2003, pp. 1-4.

[12] V. Jeffrey, "The Art & Science of Web Design", 2000 Chapter 1 Page 18.

[13] A. R. Puerta, "A Model-Based Interface Development Environment", IEEE SOFTWARE , 14 (4), 1997 , pp. 40-47

[14] Y. Tokuda, E. S. Lee, N. Shiratori, "Synthetic and Analytic Methods for User-Computer Interaction Design," icoin, pp.0726, 13th International Conference on Information Networking (ICOIN'98), 1998.

[15] L. Hochstein. (2002). GOMS [Online]. Available: http://www.cs.umd.edu/class/fall2002/cmsc838s/tichi/printer/goms.html

[16] John, Bonnie and Kieras, David E. (1996b). The GOMS Family of User Interface Analysis Techniques: Comparison and Contrast, *ACM Transactions on Computer-Human Interaction 3,4* (December 1996b), pp. 320-351.

The Effect of Adaptive Gain and Adaptive Momentum in Improving Training Time of Gradient Descent Back Propagation Algorithm on Approximation Problem

Norhamreeza Abdul Hamid[1,*], Nazri Mohd Nawi[1] and Rozaida Ghazali[1]
[1]Faculty of Science Computer and Information Technology, Universiti Tun Hussein Onn Malaysia,
P. O. Box 101, 86400 Parit raja, Batu Pahat, Johor, Malaysia
*gi090007@siswa.uthm.edu.my

Abstract

The back propagation algorithm has been employed to solve a wide range of practical problems. Despite many successful applications, it also has some drawbacks since it uses gradient descent method. Improper selection of parameters such as network topology, initial weights and biases, learning rate, momentum coefficient, activation function and value for the gain in the activation function can slow learning convergence and get stuck at local minima. Previous researchers demonstrated that in 'feed forward' algorithm, the slope of the activation function is directly influenced by a parameter referred to as 'gain'. This research proposed a further improvement on the current working Gradient Descent Back propagation Algorithm by changing adaptively momentum coefficient. The proposed algorithm change adaptively gain and momentum value for each node and the influence of those adaptive parameters on the learning ability of neural network is analysed. The efficiency of the proposed algorithm is compared with conventional Gradient Descent Method and Gradient Descent Method with Adaptive Gain on function approximation problem using batch modes training. The result shows that, the proposed algorithm has a better convergence rate with an improvement ratio of nearly 1.4 times better for the total converges time.

Keywords

Back propagation algorithm, gradient descent, gain, activation function, adaptive momentum.

INTRODUCTION

Artificial Neural Network (ANN) is a powerful set of adaptive learning techniques to detect and extract patterns and trends that are too complex to be identified otherwise [1]. Further, ANN can exhibit a surprising number of characteristics of human [2] which has the capability to learn from experience through examples fed to it, generalizing the captured knowledge for future solutions, and self-updating [3]. More specifically, ANN is a class of flexible nonlinear regression, discriminant and data reduction models. By detection complex nonlinear relationships in data, ANNs can help to make predictions about real-world problems [4]. Multilayer perceptron is one of the most popular neural network models due to its clear architecture and comparably algorithm [5].

A standard multilayer perceptron consists of input layer, hidden layer and output layer. Each of these layers contains nodes. Each node in a layer is connected to the nodes in the subsequent layer. Back Propagation (BP) algorithm is a systematic method for training multilayer perceptron [6]. This algorithm has been successfully applied to wide range of practical problems [7], [8] which uses the gradient descent method to correct the network weights formula. A BP is a supervised learning technique that uses a gradient descent rule which attempts to minimize the error of the network by moving down the gradient of the error curve [9]. This algorithm is used more than all other combined and used in many different types of applications [10]. Although this algorithm is used successfully, it has some limitations. Since BP algorithm uses gradient descent method, the problems include a slow learning convergence and easy convergence to local minima. Furthermore, the convergence behavior of the back propagation algorithm depends on the choice of initial weights and biases, network topology, learning rate, momentum coefficient, activation function and value for the gain in the activation function. Hence, improving the application of BP algorithm remains an important research issue.

In recent years, a number of research studies have attempted to overcome these problems. These involved the development of heuristic techniques, based on studies of properties of the conventional back propagation algorithm. These techniques include such idea as varying the learning rate, using momentum and gain tuning of activation function. In [11] some convergence results are given where the learning fashion of training examples is batch learning. These results are of global nature in that they are valid for any arbitrarily given initial value of weights. The key for the convergence analysis is monotonicity of the error function during the learning procedure, which is proved under the uniformly boundedness assumption of activation function and its derivatives. However, in order to obtain strong convergence, we assume the error function is equivalently convex, which is little intense. Kamarthi and Pittner [12] presented a universal acceleration technique for the back propagation algorithm based on extrapolation of each individual interconnection weight. This requires the error surface

to have a smooth variation along the respective axes, therefore extrapolation is possible. For performing extrapolation, at the end of each epoch, the converge behaviour of each network weight in back propagation algorithm is individually examined. They also focused on the use of standard numerical optimization techniques. Though, this technique often must be tuned to fit a particular application. Møller [13] explained how conjugate gradient algorithm could be used to train multi-layer feed forward neural networks. In this algorithm a search is performed along conjugate directions, which generally leads to faster convergence than steepest gradient descent directions. The error function is guaranteed not to increase consequently of the weights update. However, if it reaches a local minimum, it remains forever, as there is no mechanism for this algorithm to escape. Lera et al. [14] described the use of Levenberg-Marquardt algorithm for training multi-layer feed forward neural networks. Though, the training times required strongly depend on neighbourhood size.

Using a momentum term is the simplest method to avoid oscillation problems during the search for the minimum value on the error surface [5]. The addition of momentum coefficient can help smooth out the descent path by preventing extreme changes in the gradient due to local anomalies [15]. Consequently, it is liable to suppress any oscillation that result from changes in the slope of the error surface. The momentum coefficient is typically chosen to be constant in the conventional back propagation algorithm with momentum. However, such a momentum with a fixed coefficient seems to speed up learning only when the current downhill gradient of the error function and the last change in weight have a similar direction, while the current negative gradient is in an opposing direction to the previous update, the momentum may cause the weight to be adjusted up the slope of the error surface instead of down the slope as desired [16]. In order to make learning more effective, it is necessary that the momentum should be varied adaptively rather than being fixed throughout the training process.

Nazri et al. [17] demonstrated that changing the 'gain' value of logistic sigmoid activation function adaptively for each node can significantly reduce the training time. For the j^{th} node, a logistic sigmoid activation function which has a range of $[0,1]$ is a function of the following variables, viz

$$o_j = \frac{1}{1 + e^{-c_j a_{net,j}}} \quad (1)$$

where,

$$a_{net,j} = \left(\sum_{i=1}^{l} w_{ij} o_i \right) + \theta_j \quad (2)$$

where,

o_j output of the j^{th} unit.

o_i output of the i^{th} unit.

w_{ij} weight of the link from unit i to unit j.

$a_{net,j}$ net input activation function for the j^{th} unit.

θ_j bias for the j^{th} unit.

c_j gain of the activation function.

Nazri et al. [17] demonstrated that the value of adaptive gain parameter, c_j, directly influences the slope of the activation function.

Based on [17], this paper proposed a further improvement algorithm that will change the gain value and momentum adaptively which significantly improve the performance of the back propagation algorithm. In order to verify the efficiency of the proposed algorithm, the performance of the proposed method will be compare with the current working gradient descent method with adaptive gain (GDM/AG) [17], some simulation experiments was performed on a function approximation problem using batch mode training.

The paper is organized as follows. In Section II, the proposed algorithm is presented. The performance of the proposed algorithm is tested on approximation problem is conducted in Section IV. This paper is concluded in the final section.

THE PROPOSED ALGORITHM

In this section, an improved algorithm for modifies adaptively the gain value of activation function and momentum for each node is proposed which is implemented for the batch mode training. In the batch mode training weights, biases, gains and momentum terms are updated after one complete presentation of the entire training set. An epoch is defined as one complete presentation of the training set. A sum squared error value is calculated after the presentation of the training set and compared with the target error. Training is done on an epoch-by-epoch basis until the sum squared error falls below the desired target value. The following iterative algorithm is proposed for the batch mode of training. The weights, biases, gains and momentum coefficient are calculated and update for the entire training set which is being presented to the network.

For a given epoch,
For each input vector,
Step 1. *Calculate the weight and bias values using the previously converged gain value and momentum coefficient.*
Step 2. *Use the weight and bias value calculated in* ***Step (1)*** *to calculate the new gain value and randomly generate momentum coefficient.*
Repeat ***Step (1) and Step (2)*** *for each input vector and sum all the weights, biases, momentum and gain*

updating terms.
Update the weights, biases, gains and momentum coefficient using the summed updating terms and repeat this procedure on an epoch-by-epoch basis until the error on the entire training data set reduces to a predefined value

RESULTS AND DISCUSSIONS

The performance criterion used in this research focuses on the speed of convergence, measured in number of iterations and CPU time. It was validated on a standard feed forward neural network with one hidden layer having five hidden nodes. The training data set is created by using the function $y = \sin(2 \times \pi \times x)$ where $x \in [0,1]$. The simulations have been carried out on a Pentium IV with 2 GHz HP Workstation, 3.25 GB RAM and using MATLAB version 7.10 (R2010A).

On each problem, the following two algorithms were analyzed and simulated.

- The gradient descent method with adaptive gain (GDM/AG) [17]
- The proposed gradient descent with Adaptive Gain and adaptive momentum (GDM/AGAM)

The both of algorithms trained using 0.3 as the learning rate value to achieve a target error, 0.01. The gradient descent training algorithm was employed in a batch mode with adaptive changes in weight, bias, momentum and gain values. The initial weights for both algorithms were chosen in the range $[-1,+1]$. The best momentum term for GDM/AG is 0.5 while the momentum term is initialized randomly from range $[0.2,0.9]$ for the proposed algorithm. Both algorithms were trained with adaptive gain with an initial value of unity for gain parameter for all outputs. The network output (continuous curve) is shown against the training data points (circles) in Figure 1 and the output of required epoch is shown in Figure 2.

Figure 2 shows that the proposed algorithm (GDM/AGAM) exhibit very good average performance in order to achieve the target error. The proposed algorithm (GDM/AGAM) needs only 424 epochs to converge as opposed to the GDM/AG at about 610 epochs. Apart from speed of convergence, the time required for training the classification problem is another important factor when analyzing the performance. The results in Figure 3 clearly show that the proposed algorithm (GDM/AGAM) outperform GDM/AG with an improvement ratio, nearly 1.4, for the total time of converge. The output of the proposed algorithm network training using adaptive gain and adaptive momentum (line curve) with GDM/AG [17] (dotted curve) also plotted in Figure 1.

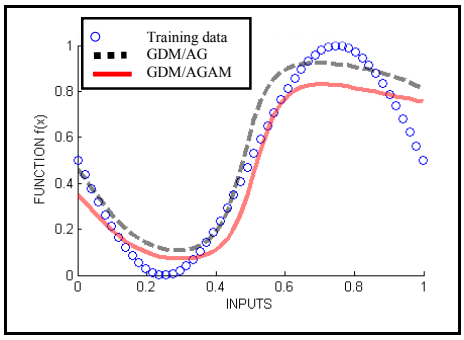


Figure 1: Output of neural network trained to learn a sine curve in batch mode training

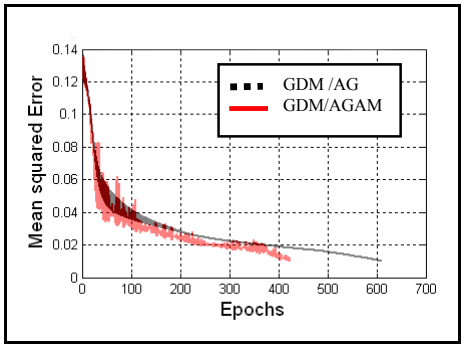


Figure 2: Performance comparison of GDM/AG and GDM/AGAM in terms of required epoch to achieved target error

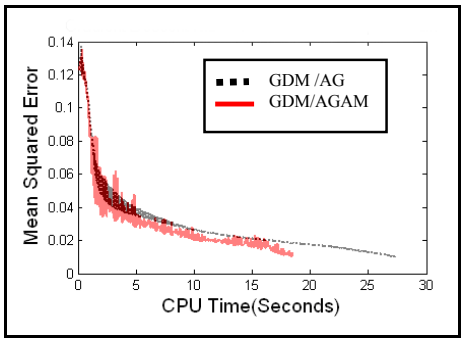


Figure 3: Performance comparison of GDM/AG and the proposed GDM/AGAM in terms of CPU time to achieved target error

Thus, from the experimental results, we can claim that in general, the proposed algorithm (GDM/AGAM) presents better performance than GDM/AG in terms of speed of convergence, measured in number of iterations and CPU time. Moreover, when comparing the proposed algorithm with GDM/AG, it has been empirically demonstrated that the proposed algorithm (GDM/AGAM) performed highest accuracy than GDM/AG. This conclusion enforces the usage of the proposed algorithm as alternative training algorithm of back propagation neural networks.

CONCLUSION

Although back propagation algorithm is widely implemented in the most practical neural networks applications and performed relatively well, this algorithm still needs some improvements. We have proposed an algorithm to adaptively change the gain parameter of the activation function and momentum coefficient to improve the training time. It shows that changing the gain parameter of activation function and momentum coefficient adaptively will affect the speed of convergence in the network. In order to verify the effectiveness of the proposed algorithm the function approximation problem was simulated and analyzed using batch mode training. The result shows that modified adaptively the gain parameter and momentum coefficient has a better convergence rate with an improvement ratio of nearly 1.4 times better for the total time converges.

ACKNOWLEDGMENTS

The authors would like to thank **Universiti Tun Hussein Onn Malaysia (UTHM)** for supporting this research under the Postgraduate Incentive Research Grant (Vote 0682).

REFERENCES

[17] Kaya A. Slope Resudial Strength Evaluation using Artificial Neural Networks. *Geotech Geol Eng*., 27(2), (2009): 281-289.

[18] Elhaq T.M.S., Wang, Y-M. Risk Assessment for Bridge Maintenance Projects: Neural Networks versus Regression Techniques. *J. Comput Civil Eng*., 21(6), (2007): 402-409.

[19] O¨ ztas, A., Pala, M., O¨ zbay, E., Kanca, E., C¸ ag˘ lar, N., Asghar Bhatti, M., Predicting the compressive strength and slump of high strength concrete using neural network. *Constr. Build. Mater*. 20 (9), (2006): 769–775.

[20] Sengur, A., Turkoglu, I., & Ince, M. C. Wavelet packet neural networks for texture classification. *Expert Systems with Applications*, 32(2), (2007).

[21] H. Yan, Y. Jiang, J. Zheng, C. Peng and Q. Li, A Multilayer Perceptron-Based Medical Decision Support System for Heart Disease Diagnosis, *Expert Systems with Applications,* 30(2), (2006): 272–281.

[22] S. N. Sivanandam, S. N. Deepa, *Principals of Soft Computing*, Wiley-India, New Delhi, India. (2008).

[23] Lee, K., Booth, D., and Alam, P. A., Comparison of Supervised and Unsupervised Neural Networks in Predicting Bankruptcy of Korean Firms, *Expert Systems with Applications*, 29(1), (2005): 1–16.

[24] Zou, H., Xia, G., Yang, F. and Yang, H., A Neural Network Model Based On The Multi-Stage Optimization Approach For Short-Term Food Price Forecasting In China. *Expert Systems with Applications*, 33(2), (2007): 347-356.

[25] A. Majdi and M. Beiki, Evolving Neural Network Using Genetic Algorithm for Predicting the Deformation Modulus of Rock Masses, I*nternational Journal of Rock Mechanics and Mining Science*, 47(2), (2010): 246–253.

[26] Mutasem, K. S. A., Khairuddin, O. and Shahrul, A. N., Back Propagation Algorithm: The Best Algorithm among the Multi-layer Perceptron Algorithm, *International Journal of Computer Science and Network Security*, 9(4), (2009): 378 – 383.

[27] N. M. Zhang, W, Wu, G. F. Zheng, Deterministic Convergence of Gradient Method with Momentum for Two-layer Feed Forward Neural Networks, *IEEE Transactions on Neural Networks*, 17(2), (2006): 522–525.

[28] Kamarthi S. V., Pittner S., Accelerating Neural Network Training using Weight Extrapolations, *Neural Networks*, (12), (1999): 1285–1299.

[29] Møller M. F., A Scaled Conjugate Gradient Algorithm for Fast Supervised Learning, *Neural Networks*, 6(4), (1993): 525–533.

[30] Lera G., Pinzolas M., Neighborhood based Levenberg-Marquardt Algorithm for Neural Network Training, *IEEE Transaction on Neural Networks*, 13(5), (2002): 1200–1203.

[31] Sun, Y. J, Zhang, S. Miao, C.X. and Li, J. M., Improved BP Neural Network for Transformer Fault Diagnosis, *Journal of China University of Mning Technology*, 17(1), (2007): 138–142.

[32] H. Shao, G. Zheng, A New BP Algorithm with Adaptive Momentum for FNNs Training, *Intelligent Systems*, WRI Global Congress on, (2009): 16–20, WRI Global Congress on Intelligent Systems.

[33] Nazri Mohd Nawi, M. R. Ransing, R. S. Ransing, An Improved Conjugate Gradient Based Learning Algorithm for Back Propagation Neural Networks. *International Journal of Computational Intelligence*, 4(1) ,(2007): 46–55.

Welding Bead Characteristics of Titanium Alloy (Ti-6Al-4V) Using Nd: YAG Pulsed Laser

Nur Jannah bt Md Ngajib*, Abdullah b Wagiman, Zazuli Mohid and Md Saidin b Wahab
Faculty of Mechanical and Manufacturing Engineering, University Tun Hussein Onn Malaysia
*Author's Email Address: nurjannah5882@yahoo.com

Abstract
Titanium alloy is well known as a high performance metal. This metal is widely used in automotive and medical industries for it superiority in corrosion resistant, strength and biomedical behaviors. Number of studies has been conducted to clarify its machine-ability due to critical design and high surface finishing requirements in precision parts fabrication. On the other hand, laser welding is a promising technique for its accuracy and small heat-affected zone (HAZ). In this study, the influence of processing parameters using pulsed mode Nd:YAG laser to titanium alloy Ti-6Al-4V was carried out. It has been clarified that the welding performance is largely influenced by the incident laser power, Win and pulse repetition rate, fp. Excessive laser power generates welding lines with obvious spill over and higher pulse repetition rate generates clean and constant width of welding beads. These two parameters also bring enamels effect to the welded area microstructure and the welding bead cross sectional geometry as well.

Keywords
Laser welding, pulse laser, titanium alloy, molten zone.

INTRODUCTION

Currently, the usage of titanium alloys, Ti-6Al-4V have been widen in producing the airplane structure such as the turbine disks, compressor blades, helicopter rotor hubs; space vehicles and prosthetic implants. This is for the reasons Ti-6Al-4V offers a high strength, low density and a good tensile and creep properties up to about 300oC [1,2]. However, the usage of titanium alloys is still restricted due to its high melting point (1668oC), has a great affinity to oxygen despite of great reactivity with ambient elements such as nitrogen, carbon and hydrogen at high temperatures plus titanium alloys are quite expensive even though it has demanded in the development of nonconventional refining, melting and casting techniques [1,3]. Tungsten inert gas (TIG), plasma arc, electron beam welding is typically used in welding titanium alloys until the usage of laser welding been introduced due to its high cooling rates and much harder welds produced compared to TIG and plasma arc welding [2]. While there was continuous wave laser welding and pulsed laser welding, the pulsed laser welding offers very low heat input to the weld, resulting in low distortion and capability in welding heat-sensitive components [4]. Thus, associated to those advantages, the aim of this study was to investigate the effect of assists gas type in laser welding, the maximum depth able to achieved, materials properties changes occurred after welding process and the performance of Nd:YAG laser in titanium alloy welding.

METHODOLOGY

Materials and Sample Preparation

The material used is the titanium alloy, Ti-6Al-4V which aluminum as the alpha stabilizer and vanadium as the beta stabilizer. The titanium alloy then was smoothed using grinding machine and cut into 10 x 40 x 5 mm samples using wire-cut machine before welding. Then, some of the samples were polished using sand paper grade 600 and been refined with isopropyl alcohol (IPA) before being test.

Experimental Procedures

Preliminary test was performed to examine the size of molten zone created under different laser average energy, Pavg. This is to find out the range of power that can produce molten zone with good appearance without spill over but with the maximum diameter (Table 1). Confirmation on the influence of shield gas (argon gas) application was also carried out. Experiment was also done on samples with different finishing surface; grinded and sand paper polished, to clarify the influence of different processing surface finishing conditions (Table 2).

Table 1: Processing parameters (Confirmation of laser average power)

Pulse Width Tp (ms)	1.0				
Pulse Rep. Rate fp(Hz)	20				
Energy E(J)	0.5	1.0	2.0	3.0	4.0
Average Power P_{avg}(W)	10	20	40	60	80

Table 2: Processing parameters under constant laser energy (Confirmation of laser shield gas influence)

Pulse Width Tp (ms)	1
Pulse Rep. Rate fp(Hz)	20
Energy E(J)	2.0

Investigation on the influence of laser energy changes was carried out under constant pulse width, pulse repetition rate and table speed. Specimens were

polished using sand paper and welding experiment conducted using argon gas as the shielding gas with consideration to the result obtained in the previous experiment (Table 3). Observation were done using microscope with 5X magnification lens on the molten zone form the top and cross sectional direction.

Table 3: Processing parameters under different laser energy (Confirmation of laser shield gas influence)

Pulse Width Tp (ms)	1.0			
Pulse Rep. Rate fp(Hz)	20			
Table speed v(mm/min)	450			
Energy E(J)	0.5	1.0	1.5	2.0

Further experiments were done to investigate the influence of welding speed changes with the same laser irradiation overlap area (Table 4). This is to clarify the effect of total energy increment size per-unit time but still with the same amount of energy induction per-unit area.

Table 4: Processing parameters under the same overlap area and laser energy

Pulse Width Tp (ms)	1.0			
Pulse Repetition Rate fp(Hz)	20	30	40	50
Energy E(J)	1.5			
Table speed v(mm/min)	225	337	450	562

Table 5: Processing parameters under different pulse repetition rate

Pulse Width Tp (ms)	1.0			
Pulse Repetition Rate fp(Hz)	20	30	40	50
Energy E(J)	1.5			
Table speed v(mm/min)	450			

Investigation on the effect of pulse repetition rate was done whereby the overlap area increases with the increment of pulse repetition rate. This test was conducted to verify the capability of laser energy penetration when the overlap area increases in order to obtain better welding bead appearance.

Optical metallographic procedures

All samples then were mounted and polished from 9-µm to 1-µm-polycrystalline diamond finish. The samples were then been etched using titanium alloy etching reagent solution consisting distilled water, nitric acid, hydrochloric acid and hydrofluoric acid; for approximately 3 minutes. After that, the samples were rinsed with distilled water and dried in normal air. Finally, all photomicrographs and molten zone dimensions were obtained using a metallographic microscope.

RESULTS AND DISCUSSION

Effect of energy difference on outer appearance

Figure 1 and 2 compares the result of laser in irradiation on different surface finish based various laser energy (0.5J to 4.0J). The result shows that the sand paper polished sample gives the best result of the outer appearance since the spillover of each energy value. Besides, the usage of energy of 2.0J gives the finest spill over with clean round melted zone.

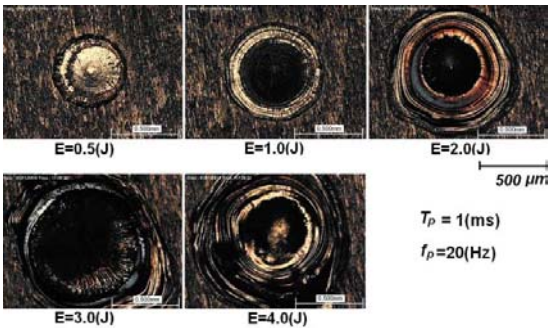


Figure 1: Effect of the spot welding on outer appearance for grinded sample

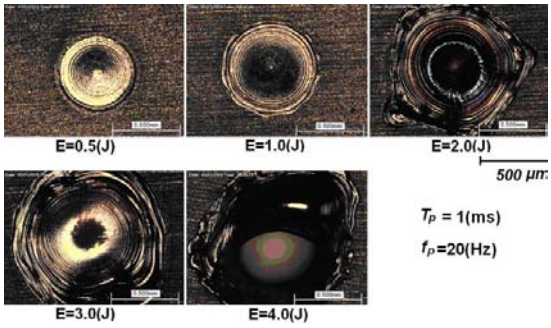


Figure 2: Effect of the spot welding on outer appearance for sand paper polished sample Figure

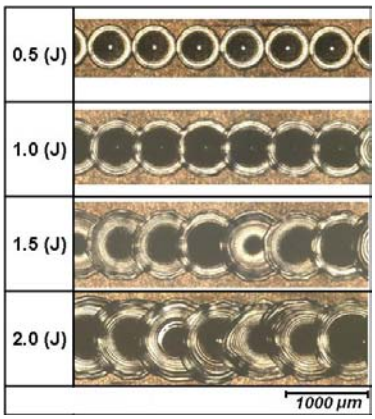
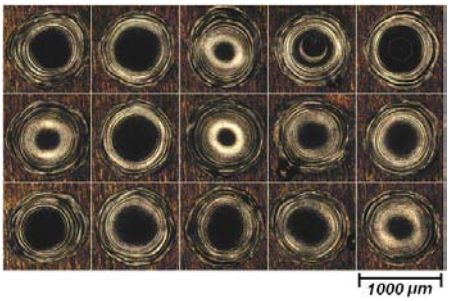


Figure 3: Effect of the laser energy to the welding bead appearance.

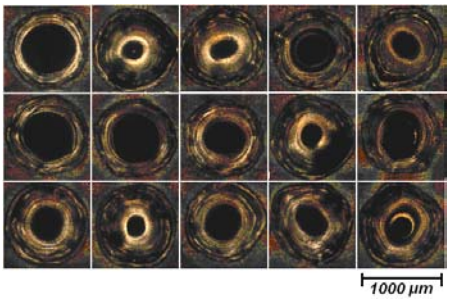
However, there are some welding spot shows the blue orange color which means that the spot is undergoes oxidation which is happen due to improper argon delivery system. Nevertheless, it is proved that the assist gas help stabilize laser welding process because the heat loss produced by its convection enhance ionization-recombination opportunities [5]. Furthermore, from Figure 3, the result shows the energy value of 2.0J produced non-constant diameter of welding beads meanwhile the 1.5J produced the better ones which the beads is more constant and clean.

Effect of constant energy on outer appearance

The experiment is done using 2.0J laser energy. The energy of 2.0J is selected and the other parameters were remained constant. The result shows the spill over became more stable and the outer diameter is definitely constant. This test which undergo for both grinded and sand paper polished samples gives almost the same result but it can be conclude that the sand paper polished surface produced better result than the grinded surface since the sand paper polished surface gives the best welding beam absorption [3].



(a) Grinded



(b) Sand paper polished

Figure 4: Comparison of molten zone shape between grinded and sand paper finished surface.

Penetration depth observations

Several experiments were conducted to observe the penetration depth of welding bead, and there are four different parameters used in order to show the comparison between the three parameters on the effect on its cross section. The result in Figure 5 shows that not the entire welding bead produced with deep penetration and the depth of the penetration is also not constant. It may happen due to insufficient energy supplied while lasering the samples. Also, it is detected there is a defect in one of the cross section viewed. The surface of the grinded sample shows many black spots likes defect and it may happen due to the grinding job and the sample then has been not polished using sand paper. Figure 6 shows the result of line welding constructed by different laser energy. It was found out that the penetration depth of each energy value is not constant and it is observed that the 2.0J shows the penetration depth not deepen as the 1.5J as but more widely than others. Thus, it can be conclude that the 1.5J of energy gives the best result of penetration depth and this value is continually used for the next experiment. Based on the result shown in Figure 6, it was decided to use the 1.5J energy to investigate the influence of speed increment under the same overlap area. Figure 7 shows the view of molten zone created under differentiation of pulse repetition rate and the speed but still with the same size overlap area. It shows a constant shape of penetration depth with approximately the same width of molten zone on the top surface.

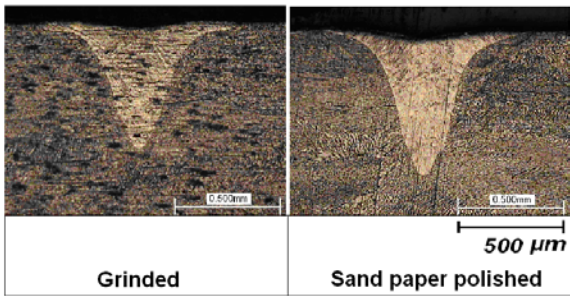


Figure 5: Comparison of cross sectional view of molten zone between grinded and sand paper finished surface.

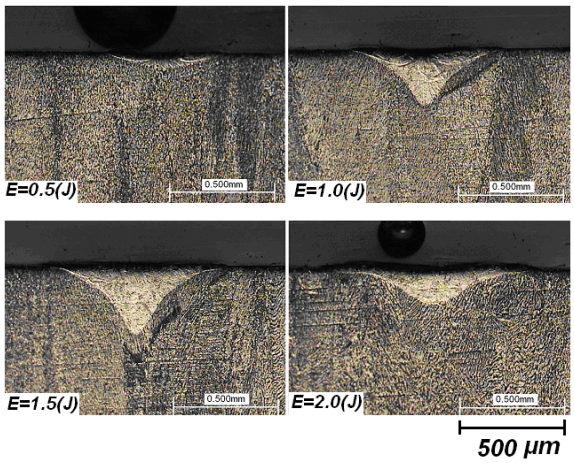


Figure 6: Penetration depth in the case of different laser energy (Tp=1ms, fp=20Hz, v=450mm/min).

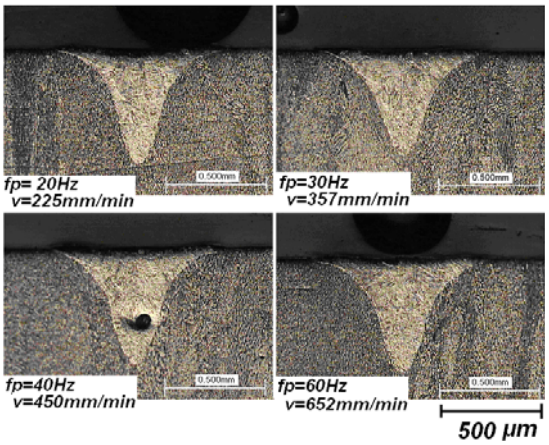


Figure 7: Penetration depth in the case of same overlap area and laser energy

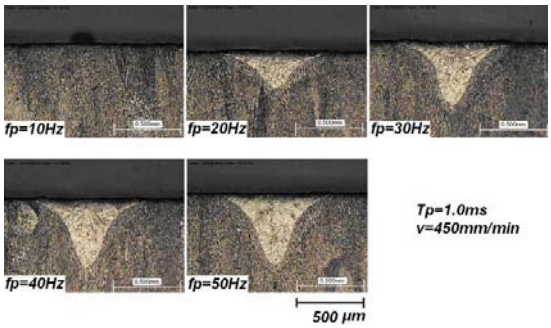


Figure 8: Penetration depth in the case of same different pulse repetition rate.

Further investigation was done using different pulse repetition rate under constant processing speed. The penetration depth increases from 10Hz to 50Hz (Figure 8). The increasing of the depth seems to be equivalent to the increasing of the pulse repetition rate. This is because the higher the pulse repetition rate used, the higher the inducing energy per unit time per unit area supplied. Additionally, the increasing of pulse repetition rate producing the larger overlapping since the time of multiple shot increases on the specific area.

CONCLUSIONS

Titanium alloy, Ti-6Al-4V was welded using pulsed Nd: YAG laser system. The outer appearance and the penetration depth of welded bead were observed using optical metallographic microscope. Thus, it can be concluding that:

1. A proper system of argon gas impacts the result of laser welding. The argon gas is assist gases which help in stabilizing laser welding process thus affect the welding bead to be cleaner and minimize the spill over.

2. The depth of the penetration is depends on many factors. Increasing in pulse repetition rate value increases the depth of penetration. And the depth also depending in the speed used while welding. The higher speed used, the more stable penetration depth obtained.

REFERENCES

[1] William D.Callister Jr. Fundamentals of Materials Science and Engineering:An Integrated Approach. John Wiley&Sons,Inc.(2005) 550-551(Second Edition)

[2] X.Cao, M.Jahazi. Effect of welding speed on butt joint quality of Ti-6Al-4V alloy welded using a high-power Nd:YAG laser. Optics and Lasers in Engineering 47 (2009). 1231-1241.

[3] C.Bertrand, O.Laplanche, J.P.Rocca. Y.Le Petitorps, S.Nammour. Effect of the combination of different welding parameters on melting characteristics of grade 1 titanium with a pulsed Nd-Yag laser. Lasers Medical Science (2007) 22:237-244.

[4] M.R.Frewin, D.A.Scott. Finite element model of pulsed laser welding. Welding Research Supplement (1999). 15-22.

[5] Hong Wang, Yaowu Shi, Shuili Gong, Aiqin Duan. Effect of assist gas flow on the gas shielding during laser deep penetration welding. Journal of Materials Processing Technology 184 (2007). 379-385.

[6] Serope Kalpakjian, Steven Schmid. Manufacturing Engineering and Technology: Fifth Edition. Pearson Prentice Hall. 2006.

[7] Walter W. Duley. Laser Welding. John Wiley & Sons, Inc. 1999.

[8] E. Akman, A. Demir, T. Canel, T. Sinmazcelik. Laser Welding of Ti6Al4V Titanium Alloys. Journal of Materials Processing Technology 209 (2009). 3705-3713.

[9] Jeff Hecht. Understanding Laser: An Entry-Level Guide. IEEE PRESS Understanding Science & Technology Series (1993). Chapter 7, pp 210 (Second Edition)

Shell Mould Reinforced With Rice Husk

N. H. Kamarudin, Z. Harun, M. S. Wahab, N. A. Badarulzaman
Faculty of Mechanical and Manufacturing Engineering, Universiti Tun Hussein Onn Malaysia, Malaysia.
E-mail: noorhasliza_kamarudin@yahoo.com

Abstract
Due to fact that thin ceramic shell mould is inherited brittle property and highly exposed to the cracking mechanism, therefore the strengthening mechanism using reinforcement method was investigated in this work. Rice husk was chosen as a reinforcement material as it contains highly percentage of silica element which can withstand a high temperature of the metal pouring process. Several testing procedures and characterization technique were carried out in order to measure the performance of the shell mould. Results show that the MOR value of the green reinforced shell mould is higher than the green body of nonreinforced shell mould. Scanning electron microscope observations also show that failure of reinforced shell mould is in the mix mode condition (highly plastic and less brittle). In fact, this reinforcement method can reduce the coated layering number in the shell mould making process.

Keywords
Reinforced ceramic shell mould, rice husk, cracking mechanism

Introduction
The production of the investment casting ceramic mould is a crucial part of the whole process and can be summarized as follows[1, 2]. The shell mould making process firstly involves the preparation of multi component slurry that composed of fine mesh refractory filler system and a colloidal binder. A pattern wax is dipped into the face coat slurry, sprinkled with coarse grained refractory stucco and dried. The dipping process is repeated many times to produce a graded mould. The failure in producing the ceramic shell mould not only leads to the defect appearance in cast component but also increase the cost of raw material and the production time. One recently patented method for producing shell production times and enhancement of ceramic mould properties is the use of organic fibber additions into ceramic slurries[3, 4]. In the present work the shell mould reinforced with organic fiber to strengthen its body and avoid cracking mechanism that lead to the failure of the shell mould.

Various combinations of materials have been used to produce the ceramic mould, but most investment foundries use a silica based binder system[5]. Typically colloidal slurry produces ceramic shell mould with very low green strength which is prone to cracking especially during dewaxing and handling[6]. Furthermore, the ceramic structure theoretically is highly sensitive to the thermal changes and also inherited the brittle property[7] which are very critical especially during the handling part in the processing stage. Therefore, the strengthening mechanism is very important in order to avoid failure of the cast component[8] and also the mould itself.

In the last few years, several investigations have been carried out in order to improve casting quality by incorporating fiber either in the form of organic and synthetic[5, 9, 10] into the ceramic shell mould system. Most of these researches proved that these fibers enhance the strength of the green and fired body of the shell mould system [9]. These improvements will lead to the ease of handling during the processing stage and also can avoid the mould failure especially during the pouring process.

In this work, the mould was reinforced with an organic fiber which comes from the agro waste which is continuation from the previous work[11]. The purpose of using these organic fibers is one alternative in reducing agro waste problem and also to reduce emission level that always associated to the casting industry due to the fact that this fiber is purely nature. As this organic fiber is purely comes from the plant which means it is easy to deteriorate, therefore its need a treatment to avoid this from happens[12, 13]. In this work some efforts have been done by treating this fiber using certain chemical elements regarding to the previous work [12, 13]. Previous work on the reinforced composite with treated natural fiber indicates that this procedure can improve the mechanical properties of the composite system[12, 13]. Properties such as modulus of rupture (MOR) and scanning electrons microscopy (SEM) were studied.

EXPERIMENTAL

Chemical treatment of rice husk
The raw rice husk used in this work is collected directly without any pretreatment from Kelantan. Basically, rice husk is characterized by low bulk density and high ash content (18–22% by weight). As mentioned before, the rice husk fiber is chosen as reinforcement in this work because it contains silica element which is the main component that can withstand high melting of pouring temperature and also sintering process of the shell mould. Silicon dioxide forms the main component (90–97%) of the ash with trace amounts of CaO, MgO, K_2O and Na_2O [14, 15].

Prior to use, the rice husk was ground and sieved to produce 6mm particle size. In addition, grinding of rice husks had also been recommended as a suitable surface modification form[16, 17]. When rice husk is burnt, the resulting black ash contains silica that carries too many impurities and exhibits some inferior properties. So the dried rice husk was treated chemically to produce high purity of silica. It has been reported that purity of silica is highly affected from chemical treatment [18-21], than thermal treatment[22]. Mineral acid leaching of rice husk is reported to be more effective than untreated rice husk for extraction of amorphous silica. Mineral acid of varying concentrations have been used to remove metallic ingredients and it is reported that HCI is the most effective than other acids. Researchers also tried organic acids on rice husk ash but it has been found that pretreatment of rice husk is better than post treatment[23].

The rice husk was immersed chemically in 5% NaOH and 95% of water for 24 hours. Then, the rice husk was thoroughly washed by distilled water several times to remove the chemical. After that, it dried in the drying oven at 80°C for 12 hours.

Shell mould production

Basically, the shell mould layering system is produced by dipping the wax pattern and follow up with the drying stage for each layers system. A method of making a ceramic shell mould comprises repeatedly coating by using treated fiber by sprinkle it around the shell mould to provide structural reinforcement to the shell mould. In this work, the immersed wax pattern was then coated with zircon sand which acts as a binder. The same procedure was done to get the second layer but using different binder which is alumina sand. This procedure was repeated for several times for the next layer with the addition of sprinkled organic fiber until a required thickness was achieved. Drying process must be carried out for each layer system and this stage needs at least two hours. In this research the process was repeated up to 4 layers.
For the first two layers the process involved only applying ceramic slurry and coated with zircon and alumina sand without applying the organic fiber. This was done in order to avoid the appearance of rough surface that could affect the surface finishing of the final product.

Strength measurements

Modulus of Rupture (MOR) test is an appropriate test to measure the strength of most of brittle material that is weak in tension and strong in compression. Due to the fact that the crack propagation are too fast, causes the plastic deformation almost not exist in ceramic material and any internal disturbance can make the failure easy to happen. Therefore, three point bending test was done according to ISO 178:93 (International Standards Organization) methods by a SHIMADZU Universal Testing Machine (Model AG-1). These tests were carried out to determine of the modulus of rupture (MOR) of the layered shell mould system. For MOR testing, the samples were prepared upon a wax pattern with dimensions of 100mmx25mmx5mm thickness.

Microscopy

Scanning electron microscopy was used to view the structure of green and fired body of ceramic shell mould. From this testing, porosity can be observed and compared for ceramic shell mould system with rice husk fiber and without fiber. The green fracture surface of ceramic shell mould with rice husk fiber and carbon fiber also was observed. Micrographs of the samples were obtained by using a JEOL, JSM-638OLA. Samples observed under the SEM were sputter coated with either gold or carbon to form a conducting layer to avoid electrical charge.

RESULTS AND DISCUSSION

Strength comparisons (Modulus of Rupture) and fracture surface.

The results of MOR values for the green shell moulds with four layers system are shown Table 1 and Figure 1. Green shell mould with rice husk fiber (without firing) shows the highest MOR value than the shell mould with carbon fiber and shell mould without fiber. Shell mould with treated fiber rice husk and carbon gives higher MOR value with the range of 1.8MPa to 2.4MPa and 1.2MPa to 1.6MPa respectively. This may be due to resistance in fracturing shell mould that has an alignment of fiber across or throughout the whole matrix of the shell mould layering systems. These conditions are shown in Figure 3a (rice husk fiber) and Figure 3b (carbon fiber) where the green fracture surfaces with the fiber pull out condition. Meanwhile, the higher MOR value for treated rice husk shell mould system is the result of very coarse or rough surface nature that has a high possibility to bind the particles or create network. This is opposite to the condition of carbon fiber that has the nature of smooth surface and easily pulls from the matrix system.

Table 1. MOR (Modulus of Rupture) Test result with 4 layers

Shell mould system	MOR value(MPa)
Shell mould without fiber	0.5-1.0
Shell mould with carbon fiber	1.2-1.6
Shell mould with rice husk fiber	1.8-2.4

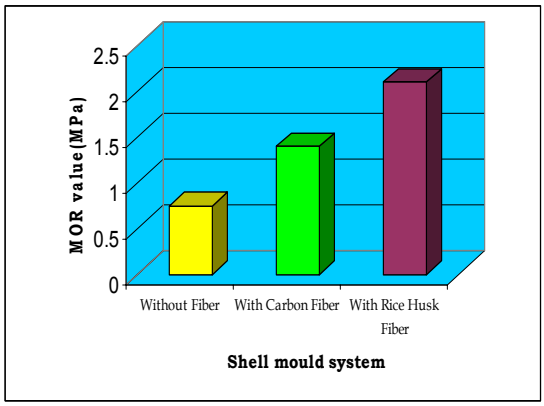
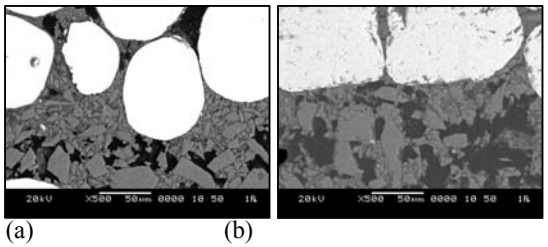


Figure1. Comparison of MOR (Modulus of Rapture) for each shell mould system

Pore structure

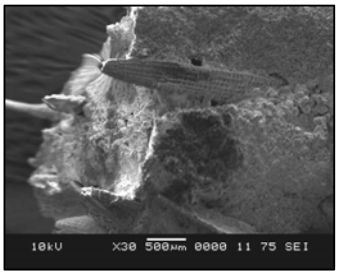
The microstructure and pore structure of shell mould fired body, with and without rice husk were observed using Scanning electron microscopy (SEM) via backscattered electron images. The observation was focused on the pore size and overall structure. From the image of SEM in Figures 2(a) and 2(b), clearly show that shell mould with rice husk fiber has bigger sizes of porosity compared to the shell mould without fiber. This may be due to the fact that rice husk consists of volatile material (70-80%) [24-26]and 20% is a RHA which has a highly silica content. This volatile element normally contributes to the increment of the pore structure in the fired shell mould body. Basically, the pore structure is very important to flow or transfer the air from the empty mould during the pouring process as the trapped air can produce bubbles or porosity to the casting component.



(a) (b)

Figure 2 Backscattered electron SEM image of cross sectional view of ceramic shell mould showing porosity left (a) ceramic shell mould without fiber; (b) ceramic shell mould with rice husk fiber

(a)



(b)

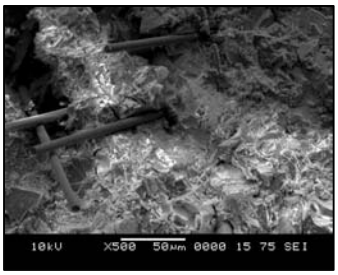


Figure 3: Secondary electron microscopy image showing the green fracture surface of shell mould; (a) shell mould with rice husk fiber, (b) shell mould with carbon fiber

CONCLUSION

The use of fiber increases the MOR value of shell mould green body which is very important in avoiding failure of the mould in the earlier stage (handling stage) that may lead to the defect appearance of the casting component. In fact the addition of the fiber also can create the pore structure after the firing stage which can increase the air flow from mould cavity during pouring process.

ACKNOWLEDGEMENTS

The technical support and funding provided by the Universiti Tun Hussein Onn Malaysia is acknowledged and appreciated**.**

REFERENCES

[1] Beeley, P.R.a.S., R. F., *Investment Casting.* Institute of Materials, 1995((1st ed.)).

[2] Meulenberg, W.A., Telle, R., Rothe, H. and Sahm, P. R., *Fabrication and investigation of ceramic shell moulds for investment casting.* CFI-Ceram. Forum Int, 2000. **77**: p. 30-35.

[3] Duffey, D.a.W., A., *Totally new concept in water based binders.* In Proceedings of 25th BICTA Conference on Investment Casting, 2001(paper 11).

[4] Jones, S.a.Y., C., *Advances in shell moulding for investment casting.* J. Mater. Process. Technol., 2003. **135**(2/3): p. 258-265.

[5] C. Yuan, S.J., *Investigation of fibre modified ceramic moulds for investment casting.* Journal of the European Ceramic Society, 2003. **23**: p. 399-407.

[6] Jones, S., *Improved Sol Based ceramic mould for the use in investment casting*. 1993, University Of Birmingham, Egbaston, UK.

[7] Scherer, G.W., *Theory of drying.* Journal of American Ceramic Society, 1990. **73**(1): p. 3-14.

[8] Manuel Guerra, J. *Factors affecting shell strength and the effect of dry time on shell strength*. in *22nd EICF Conference*. 1992. Paris.

[9] Jones. S, e.a., *Advances in shell moulding for investment casting.* Journal of Materials Processing Technology, 2003. **135**: p. 258-265.

[10] C. Yuan, S.J., S. Blackburn, *The influence of autoclave steam on polymer and organic fibre modified ceramic shells.* Journal of the European Ceramic Society 25, 2004: p. 1081-1087.

[11] Z. Harun, N.S., M. N. Mohd Hatta, A. Khalil, A. M. Ahmad Zaidi, *Reinforced Shell Mould (with palm oil fiber).* ITEX, 2009.

[12] Mwaikambo LY, A.M., *Die Angewandte MakromolekulareChemie.* 1999: p. 272:108-24.

[13] Mohanty AK, K.M., Hinrichsen G. Compos Sci Technol, 2000: p. 60:1115-24.

[14] Natarajan, E., Nordin, A. and Rao, A. N., *Biomass Bioenergy.* Overview of combustion and gasification of rice husk in fluidized bed reactors, 1998. **14**: p. 533.

[15] Kaupp, A., *Gasification of Rice Hulls: Theory and Practice.* 1984.

[16] Vasishth, R., Assignee: Cor Tech Research Ltd. Patent, P.N. US 3850677, I.D.: 741126, 1974.

[17] Ndazi, B., *The performance of hydrolyzed tannin-CNSL resin in rice husk particleboards, M.Sc. thesis. University of Dar es Salaam.* 2001.

[18] H. D. Banerjee, S.S., H. N. Acharya, *Investigation on the production of silicon from rice husks by the magnesium method.* Materials Science and Engineering, 1982. **52**: p. 173-179.

[19] P. Mishra, A.C., H. D. Banarjee, *Production and purification of silicon by calcium reduction of rice husk white ash.* Journal of Materials Science, 1985. **20**: p. 4387-4391.

[20] A. A. M. Daifullah, N.S.A., S. A. El- Reefy, *Purification of wet phosphoric acid from ferric ions using modified rice husk.* Chemical Engineering and Processing, 2004. **43**: p. 193-201.

[21] M. Patel, A.K., P. Prasanna, *Effect of thermal and chemical treatments on carbon and silica contents in rice husk.* Journal of Materials Science, 1987. **22**: p. 2457-2464.

[22] N. Ikram, M.A., *X-Ray diffraction analysis of silicon prepared from rice husk ash.* Journal of Materials Science, 1988. **23**: p. 2379-2381.

[23] S. H. Javed, S.N., N. Feroze, M. Zafar, M. Shafaq, *Crystal and amorphous siica from KMnO4 treated and untreated rice husk.* Journal of Quality and Technology Management, June 2010. **VI**(1): p. 81-90.

[24] Mehta, P.K., *Rice-husk ash- a unique supplementary cementing material.* In: Proc advances in concrete technology, 1992: p. p.419-43.

[25] Malhotra VM, P.K.M., *Pozzolanic and cementitous materials.* In: Advances in concrete technology,1:Canada, Gordon and Breach Publ, 1996.

[26] R. V. Krishnan, J.S., T. Jagadish Kumar, *Studies on the formation of black particles in rice husk silica ash.* Journal of European Ceramic Society 21, 2001.

Enabling Knowledge Management in a Collaborative Planning and Scheduling Platform

Siti Fazreena Idayu Bahtiar[1,]* and C. P. Gomez[2,]
[1,2]Universiti Tun Hussein Onn Malaysia
*fazreenaidayu@yahoo.com

Abstract
As the world is experiencing the impact of the knowledge economy, it is evident from extant literature that knowledge and information technology (IT) have been identified as critical success factors for strategic formulation of businesses. This is especially significant in the area of construction industry as it plays an essential role in the socio economic development of a country. However, the success in implementing IT enabled knowledge management (KM) is limited in the construction sector. The purpose of this paper is to present the prototype of a web-based system to enable KM by developing a platform for collaborative construction planning and scheduling. Additionally, this research is focused on studying current practice on KM and developing a bottom-up practitioner-centred KM system for enhancing construction productivity. As such, taking an action research approach, a case study was documented to map out the information flow and the KM mechanism. A key finding of the paper is the appropriateness for using a socio-technical modeling approach for KM in construction production. The key features of the socio-technical web-based model for KM are discussed in this paper based on the optimization of collaborative working environment.

Keywords
Knowledge Management, Planning and Scheduling, Socio-technical system, Web-based Collaborative Technology.

INTRODUCTION

The world is experiencing an era which has been termed the "knowledge age" or the "knowledge economy" [1]. According to [2], the knowledge economy is emerging from two defining forces: the rise in *knowledge intensity* of economic activities, and the increasing *globalisation* of economic affairs. The rise in knowledge intensity is being driven by the combined forces of the information technology revolution and the increasing pace of technological change.

For many organizations, the knowledge economy involves rapid change, uncertainty and turbulence. Knowledge Management (KM) is central to this and is increasingly recognized as an integral part of an organisation's strategy to improve business performance [3]. The issues of knowledge production, transmission and transfer are important facets of the knowledge economy [4]. KM plays an essential role in socio economic development of a country. It is noted by [5], that an increasing number of construction organizations are applying project improvement initiatives centred on knowledge management concepts, to improve their performance.

PROBLEM STATEMENTS

Major research work on ICT enabled KM in the construction industry has mainly been focused on developing sophisticated tools and techniques, whilst ICT as a clear enabler for KM is not developed or evolved based on 'growing' and specific needs of the processes involved. This research identifies the Planning and Scheduling process as a key process that has been the 'victim' of some of the major previous research work.

Planning and scheduling activity is known for its focal point that touches all other processes in construction projects [6]. This activity is one of the most important functions in a supply chain to achieve high quality products at lower cost, lower inventory and high level of performance. Solving the problem is essential for the generation of flexible process sequence with resource selection and for the decision of the operation schedules that can minimize makespan [7].

This prototype is developed to provide the knowledge management capacity for enhancing the construction planning and scheduling activities. It is observed by [8], that failure to capture and transfer knowledge generated within one project, which is usually buried in unread reports and arcane filing systems, or lost because people move on, leads to wasted activity and impaired project performance. Having undertaken a preliminary case study on current practice of KM for planning and scheduling of construction projects, numerous shortcomings have been identified. One important shortcoming was the lack of emphasis on *collaborative planning and scheduling* as a suitable enabler for KM.

[1] MSc Student (HP080007), Faculty of Technology Management, Business and Enterprenuership (FPKTPK), UTHM. fazreenaidayu@yahoo.com; +6 07 453 7000

[2] Senior Lecturer, Faculty of Technology Management, Business and Enterprenuership (FPKTPK), UTHM. cpgomez@uthm.edu.my; +6 07 453 7000

Although technology has an important role to play, experts have argued that KM cannot be implemented using technology alone [9, 10]; it has to have a human integration aspect. As such, in this study a *socio-technical system* was designed using the case study approach where the real situation of practice is presented without attempting to have an agenda to solely focus on high automation (often attempting to replace expert knowledge with intelligent agents). This is considered as an important aspect of the research, as most research has tended to overemphasize infrastructure requirements as opposed to functional and operational requirements. For construction projects that are fragmented in nature and temporary this is a vital consideration wherein customization becomes a critical feature.

RESEARCH METHOD

A preliminary exploratory case study was conducted to enable the action researcher the opportunity to map out current practice and initiate analysis on current weaknesses. According to [11], this methodology normally is undertaken before implementing a large-scale investigation as it helps identify questions, select measurement constructs, develop measures and also safeguard investment in a larger study.

Case Study Profile

A G7 contractor company, Gadang Perembun Consortium was selected as a case study. Currently in charge of delivering a Hospital Rehabilitation Project in Cheras, the project tender sum is RM341,900,000.00 with a 39 month duration for completion. This project is categorised as a complex and dynamic requiring a reliable master work programme and good work coordination due to the multiple sub-contracts involved in the huge amount of work. Taking the area of planning and scheduling as the focus of the study, the researcher worked closely with the project planner, Planner A to get an indepth view of the planning and scheduling process and map it.

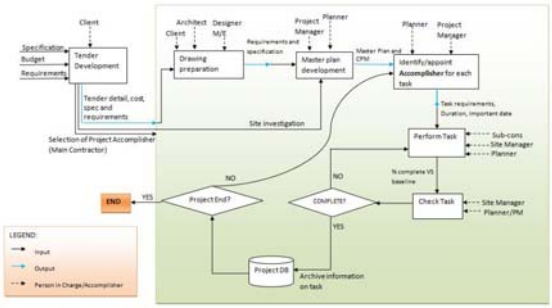


Figure 1.1 Information Flow Process Model

Findings

The Planner A instituted a non-collaborative planning and scheduling coordination basic IT tool in order to enhance the process. However, it was clear that the Planner A who also introduced the concept of using the Last Planner to obtain more reliable planning, managed to obtain some improvements, basically focusing on information processing, whilst neglecting the opportunity of developing its formal KM capacity for enhancing the planning and scheduling activity. Figure 1.1 shows the information flow process model without the formal KM mechanism.

ACTION RESEARCH DEVELOPMENT

From the model, the requirements for a web-based system based on a socio-technical system concept was seen to be a more viable system to undertake the efforts initiated by Planner A for enhancing the planning and scheduling. This was identified based on the requirement of retaining the 'experts'-the Last Planners on the task as key networking agents, as substituting them with automation in terms of artificial agent was found not practical and only remotely possible. The key additional feature that was considered necessary was in order to have a high impact on further enhancing the planning and scheduling activity was the KM aspect. The KM processes was devised to be triggered simultaneously with the flow of information. An engineering research and development methodology was undertaken to develop the required web-based KM mechanism.

PROPOSED SYSTEM

In this paper, the engineering system development had been simplified using the living system concept. This concept demands system requirements, build a prototype, survey representative users and evolve the prototype [12]. To identify system requirements, an overall system view was made using the composition diagram indicating users and main processes or module involved in the system environment (see Figure 1.2). Based on the socio-technical concept, the technical refers to infrastructure, while social refers to the people and processes that influence decisions [13].

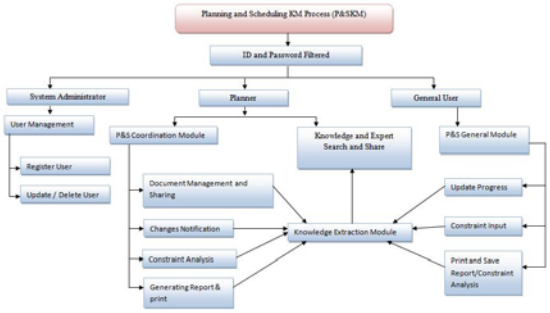


Figure 1.2 Decomposition Diagram

Prototype System Features

The web-based concept is used in presenting this KM application because of its ability to overcome the time and distance barrier as the construction environment itself that are physically disperse to enable continuous networking and collaboration as opposed to current intermittent approach. This prototype also offers secure KM platforms as it has restriction function that

allows only registered user to access the system (see Figure 1.3).

Figure 1.3 Login Function

The KM processes starts when the need of knowledge is triggered and in this case, the knowledge is triggered when problems arise and also when there are task to assign. Figure 1.4 shows the KM processes in a standard problem solving environment with the screenshots to show how this prototype function. While Figure 1.5 shows the process flow and KM processes that occurs in collaborative planning environment that promotes the last planner concept of making task ready to provide a more reliable planning decision. As these decisions for both problem solving and task management are stored in permanent knowledge base, the system is allowed to grow and adapt based on the learning process when there is added customization made to the existing problems and task captured in the knowledge based.

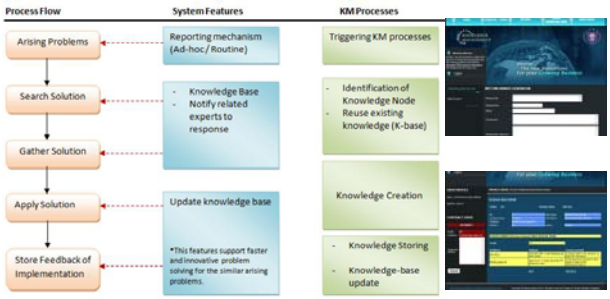


Figure 1.4 KM Processes in Problem Solving

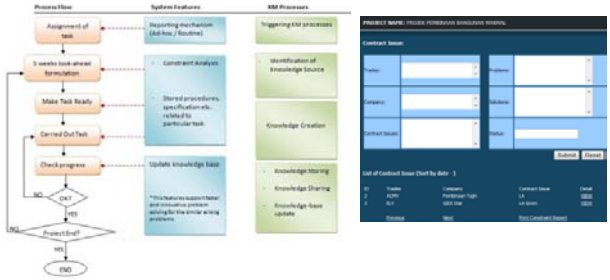


Figure 1.5 KM processes in constraint analysis

This KM processes was formulated after considering the knowledge type involved in each stage of the planning and scheduling process. This research focuses on the explicit knowledge such as procedural, causal, pragmatic, strategic and declarative knowledge. While the aspect of managing tacit knowledge takes place by adapting Nonaka's concept on knowledge conversion in which the tacit knowledge are made explicit and vice versa via the LP agents that carried out the conversion processes (See Figure 1.6).

Knowledge	to Tacit	to Explicit
from Tacit	**Socialization** Sharing ideas, feelings, experiences etc.	**Externalization** Concepts, models, metaphors, book of procedure etc.
from Explicit	**Internalization** Learning by doing, training etc.	**Combination** Joining new information (concepts) etc.

Figure 1.6 SECI Model [14]

DISCUSSION AND CONCLUSION

This initial KM system for planning and scheduling is to be piloted and further improved based on feedback. From a total project perspective, this KM enabling web-based system is initiated within the planning and scheduling scope of the project and it is proposed that within planning and scheduling the technical component is a major one compared to the social in terms of structure. However, the additional KM components structured for the various other project activities are to be designed as merging and complementing the planning and scheduling process. This is then to form the Integrated KM enabling web-based system. The real-time test run for this prototype will be carried out in the later phase of this research project using the case study approach. While to get more reliable data, a questionnaire survey on prototype features and mechanism will be distributed among G7 contractors to assess their general acceptance on KM implementation model.

ACKNOWLEDGMENTS

This research work was a part of MSc Research study titled 'Modelling the Knowledge Management Processes in the Construction Industry Based on State-of-the-art technology', which was fully funded by MOSTI under the National Science Fellowship Scheme. This study was fully monitored and supervised by Dr Christy P. Gomez whom also a co-author for this paper. The cooperation from Information Technology Center, Universiti Tun Hussein Onn Malaysia is highly appreciated in assisting in providing the server side scripting and system installation.

REFERENCES

[1] Sunassee, N.N. and Sewry, D.A. (2002). A theoretical framework for knowledge management implementation. *Proceedings of SAICSIT*. Africa: ACM. pp. 235-245.

[2] Houghton, J. And Sheehan, P. (Ed.) (2000). *A Primer on the Knowledge Economy*. Victoria

University: Centre for Strategic Economic Studies.

[3] Carillo, P.M. *et. al.* (2003). IMPaKT: A Framework for Linking Knowledge Management to Business Performance. *Electronic Journal of Knowledge Management.* 1(1), 1 12.

[4] Egbu, C.O. and Robinson, H.S. (2005). Construction as a Knowledge-Based Industry. in Anumba, C.J., Egbu, C and Carillo, P. *Knowledge Management in Construction.* Blackwell Publishing. pp. 31-49.

[5] Mohamed, S.F. and Anumba, C.J. (2006). Potential for improving site management practices through knowledge management. *Construction Innovation, Vol.6.* pp 232-249.

[6] Prince, E. (2007). *Control Engineering: Effective Process Planning and Scheduling.* Aspen Technology: UK

[7] Chiung, M. et al., (2007). Integrated Proces Planning and Scheduling in a Supply Chain. *Computers & Industrial Engineering.* 54(2008). pp. 1048-1061

[8] Carillo, P.M., Anumba, C.J. and Kamara, M. (2000). Knowledge Management Strategy for Construction: Key IT and Contextual Issues. *Construction Informatics Digital Library.* Retrieved July 26, 2009 at http://itc.scix.net/

[9] Davenport, T.H. and Prusak, L. (1998). *Working Knowledge: How Organization Manage What They Know.* Harvard Business School Press.

[10] Dave, B. and Koskela, L. (2009). Collaborative Knowledge Management- a construction case study. *Automation in Construction.* 18(2009). pp. 894-902

[11] Davey, Lynn (1991). The application of case study evaluations. *Practical Assessment, Research & Evaluation*, 2(9). Retrieved on September 29, 2010 from http://PAREonline.net/getvn.asp?v=2&n=9

[12] Salisbury, M and Plass, J. (2001). *A Conceptual Framework for a knowledge management system.* (DOI:10.1080/13678860010016913). Retrieved on July 28, 2010, from Human Resource Development International, Taylor & Francis. : http://www.ingentaconnect.com/content/routledg/rhrd/2001/00000004/00000004/art00002

[13] Ottens, M. et al., (2005). Modeling engineering systems as socio-technical systems. *IEEE International Conference on Systems, Man and Cybernatic*

[14] Nonaka, I.O. and Takeuchi, H. (1995). *The Knowledge-creating company: How Japanese companies create the dynamics of innovation.* Oxford University Press: Oxford.

Predictive Quality Control Using Software Inspection

Nor Azma Binti Che Harun, PM Dr Abdul Talib Bin Bon
Department of Technology Management
Faculty of Technology Management, Business and Entrepreneurship,
University Tun Hussein Onn Malaysia, Johor, Malaysia
Tel : +60139831557, HP090006@siswa.uthm.edu.my, talib@uthm.edu.my

Abstract
Over the past decade, software inspections have established an impressive track record for early defect detection and correction, and their use has grown extensively. But during this time software quality requirements have also increased, raising the level of our quality expectations. Industrial engineering has addressed similar increasing quality requirements for hardware by being able to predict problems early in development by using statistical process control (SPC). Applying SPC to software inspection data provides a similar ability to predict and remove latent problems, those that haven't been identified as yet, early in software development before they can propagate and cause later difficulty and expense. The application of SPC to software inspection data to predict defects is defined and illustrated using sample inspection data and predictive quality control tools have been applied to the software that can help early detection of unintended variation of the parts within each step. The result from actual control chart of sample data will be combining with the predictive control chart of sample data to make a comparison.

Keyword
Predictive quality control, software inspections, statistical process control, industrial engineering, process management.

INTRODUCTION

Inspections have been applied extensively for the past ten years to improve software quality, and their use has been described for large and small systems in many diverse applications. There are a number of successful variations of inspection techniques, (and some not so successful) but all are based on performing a more rather than less rigorous examination of a work product by knowledgeable peers.

Through group examination they identify defects relatively early during development. During the inspections, data about the performance of the inspection and the identified product defects are collected. Using this data, it is possible to control the quality of the developing work at each stage where it is inspected.

But, predicting possible latent problems in software is not usually done. The techniques used in hardware development, namely statistical process control, are not being applied to software development. SPC evolved from the measurement and analysis of hardware manufacturing data by Dr. Shewhart at Bell Laboratories in the 1920s. For another, the hardware

development process is substantially under control. And then, possibly most important, hardware quality measurements are predominantly reliable. Although an increasing number of software companies are trying to improve their development processes, there not too many companies seem to successfully apply SPC to their processes. (Fuggatta, 2002). It is likely same to the production area and stages nowadays. The inspection processes that have been used nowadays almost not using and applying SPC in their process.

RELATED WORKS

Software Inspection

Software inspections are a formally defined procedure whereby a peer group rigorously examines their software for possible defects. Their objective is to identify defects so that they can be corrected within the current development stage and decrease the number of problems transmitted from one development stage to the next and also substantially improving the quality of the product.

Software inspection is a proven and widely known quality assurance method. Software inspection involves careful examination of the code, design and other software artefacts, checking them for characteristics that are known to be problematic from past experience. Inspections are carried out at the beginning of the development cycle to identify and remove potential problems when fixing them is least expensive.

Software inspections are related to other peer review techniques, such as team reviews (Wiegers 2002) and walkthroughs (Humphrey 1989).Inspections can be applied to code documents long before tests are designed or even run. Humphrey (1989) states that in order to ensure a quality product, inspections should take place before the first compile or test.

On the other hand, Gilb and Graham (1993), as well as Ebenau and Strauss (1993) consider that compiling the code is an entry criterion that has to be passed before an inspection. A compiler is a cheaper way to find syntax-related defects than the inspector.

There are the typical six steps that involve in several inspection processes:

1. Planning
2. Overview
3. Preparation
4. Meeting
5. Rework
6. Follow-up

Inspection or software inspections were a process that has been introduced in many years before. It almost more than 20 years since Michael Fagan described the inspections approach. Software Inspection is one of the important and effective techniques that can be apply in every stages of development process.

Software inspections have given many benefits since it's having been introduced. Fagan (1976) who was the founder of software inspection concept and process has reported advances in software inspection and the benefits occurring from it.

Research that has been found about software inspections used reported that 38 out from 46 defects were discovered by design and code inspection. On the other hand, incorporating inspections into the software engineering process can increase the total project budget between 5 and 15 percent. (Gilb & Graham, 1993).

Software inspection has been regarded as an efficient and effective way to control the quality of software. For a critical software system, inspection serves as an essential and formal tool to verify and validate the quality of software, and good documentation provides a solid basis for inspection. (Hongying, 2004).

Quality Control

Quality Control is the use of techniques and activities to achieves, sustain, and improve the quality of a product or services. (Dale, 1994). Quality control also involves the set of activities used to ensure that the products and services meet requirements and are improved on a continuous basic. Since variability is often a major source of poor quality, statistical techniques, including SPC and designed experiments, are the major tools of quality control and improvement.

Quality control also often done on a project-by- project basis and involves team led by personnel with specialized knowledge of statistical methods and experience in applying them. (Montgomery, 2005)

Statistical Process Control (SPC)

Statistical Process Control (SPC) is the process and technique which is known to be a powerful tool that can be used to improve processes to enhance the quality and also productivity. (Wiley & Sons, 1985). Statistical process control was developed by industrial engineering to reduce the variability of parts during their manufacture. Briefly, a process is considered as a series of productive steps resulting in a product.

Statistical process control (SPC) involves using statistical techniques to measure and analyze the variation in processes. It is most effective method of monitoring a process through the use of control charts. Control charts enable the use of objective criteria for distinguishing background variation from events of significance based on statistical techniques.

Applying of Statistical Process Control (SPC)

Wiley (1991) give the outlines basic tools used for statistical control are:

1. Check Sheet
2. Cause-and-Effect Diagram
3. Scatter Diagram
4. Run Chart
5. Histogram
6. Bar Chart
7. Pareto Chart
8. Control Chart

To use SPC for the attribute data of defect density, prepare a control chart to determine which parts exceed the control limits of the set. To prepare the control chart, the defect density per part, the mean defect density for the parts, and the control limits are computed for the set of parts being measured where,

$$\bar{\mu} = \frac{\sum_{i=1}^{n} defects_i}{\sum_{i=1}^{n} part\ size_i}$$

Any parts that are near or exceed these limits will need to be carefully considered. Note that the UCLi and LCLi are different for each part as the "area of opportunity," or size of the part, varies. Approximate control limits can also be derived by using average or maximum and minimum limits for the part size for an initial estimate.

UCL and LCL Approximations

Because the size of the inspected work products vary, the UCL and LCL for the major defect density of each inspection will also vary, dependent on the size of each inspected work product (the *area of opportunity*). To simplify the use of the control charts, the UCL and LCL may be held constant over the set of analyzed inspections.

The average work product size is used to determine the UCL, and the maximum work product size is used to determine the LCL, where the LCL is never taken as less than zero. This is an approximation. However,

these simplifying assumptions provide sufficient discrimination for the initial analysis of admittedly approximate defect data. The maximum work product size was selected for the LCL to increase the sensitivity of the control chart to poorly inspected products. Using these assumptions, the UCL and the LCL for the control chart of major defect density are

The most valuable tool of SPC is Control Chart. These charts give a graphical appearance of the process giving the ability to any manager with or without the knowledge of statistics to immediately understand if the process is under control or not.

$$UCL_i = \bar{\mu} - 3\sqrt{\frac{\bar{\mu}}{\textit{maximum work product size}}}$$

where the LCL is never < 0.

The computation of the mean defect density, $\bar{\mu}$, remains unchanged.

Control chart have proven their ability to improve productivity, because the reduction of scrap and rework results in an increase of productivity, increase in production and capacity measured in the number of good parts per hour and decrease cost. On the other hand, the used of control charts helps to keep the process under control.

METHODOLOGY

The research methodology that will be used is about something process in create a new software technologies which is software inspection. The process that involved in creating that software is beginning with:

1. Built the software inspection method using Microsoft Excel Program.
2. Using the Sample of data to testing the software that have been built.
3. Applying the Statistical Process Control (SPC) in the software inspection. It involves the step of implementing SPC.
4. Predictive and forecast of quality control using the average and trends of inspection performance that gains from previous steps.

X-bar and Range Chart

An X-bar and R (range) chart is a pair of control charts used with processes that have a subgroup size of two or more. The standard chart for variables data, X-bar and R charts help determine if a process is stable and predictable. The X-bar chart shows how the mean or average changes over time and the R chart shows how the range of the subgroups changes over time. It is also used to monitor the effects of process improvement theories. As the standard, the X-bar and R chart will work in place of the X-bar and s or median and R chart.

X-bar

$$\bar{\bar{X}} = \frac{\sum(\bar{X}_1 \ldots \bar{X}_k)}{k}$$

k = is the number of subgroups

R-bar

$$\bar{R} = \frac{\sum(R_1 \ldots R_k)}{k}$$

k = is the number of subgroups

C-chart

$$UCL_c, LCL_c = \bar{c} \pm 3\sqrt{\bar{c}}$$

P-chart

$$UCL_p, LCL_p = \bar{p} \pm 3\sqrt{\frac{\bar{p}(1-\bar{p})}{\bar{n}}}$$

Forecasting Method

From the book written by Lawrence *et al*., (2009), they discussed that "*Forecasting is about the process of predicting the future*". Whether it is predicting future demand, sales or production, forecasting is an important yet unavoidable task that is an integral part of almost all business activities. By this definition concept, forecasting can be translate as the methods in predict the future in order to make the faster action taken by the prediction that makes. Forecasting will gives better effect. The management of development process can know whether the process in future will give the cause or any error or not.

They also can gain the information about what will happen in the next and also know what the best ways and techniques that can be generate to make better improvement. Forecasting is the key component in operations management. It is a central component of strategic, tactical, and operational activity. According to Arinze *et al*. (1996), there are three major classes of forecasting approaches. That is:

1) Judgement-based Methods
- These methods use human experts who makes subjective assessments of the future based on their experience on formal and informal information.

2) Survey Methods
- Survey methods are commonly used in marketing and political polls. Questionnaires, group interviews, telephone surveys, are forms of survey methods used to forecast and event e.g., future voting on intentions population.

3) Quantitative Methods

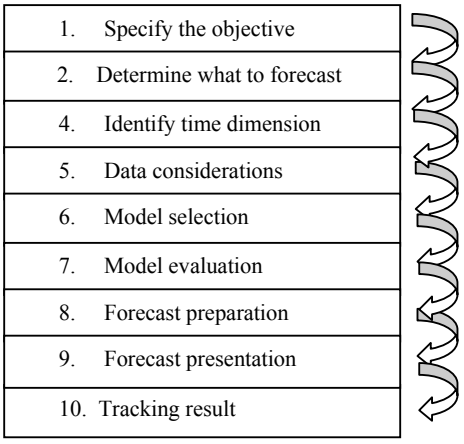
- Such methods come in the form of causal and time-series methods. Time-series methods are the most widely-used of all methods due to its simplicity. The methods use traits of the data, such as previous actual values, trends and etc to create forecast. The methods are thus more formal and consistent than other methods.

Four forecast measurement or method that have been using in the steps of forecasting choosing is:

a. Moving Average Methods
b. Holt-Winter Exponential Smoothing
c. Simple Regression Forecast Method
d. Autoregressive Integrated Moving Average (ARIMA)

In order to select the best model for the forecasting techniques and select best forecasting techniques used, the ranking method had been applied. The model or techniques with the lowest total ranking value is the best.

There are steps in forecasting process and choosing:



OBJECTIVE OF RESEARCH

1. To develop and illustrated control chart using implementation of Statistical Process Control (SPC) by using sample inspection data.
2. To develop predictive tools that can help early detection of unintended variation of the parts within each step.
3. To combine the actual control chart of sample data with the predictive control chart of sample data

SCOPE OF RESEARCH

This research will focus on where the software of inspection with the predictive quality control has been created. The scope of the research is involved 3 part. For the first part, it is where the software have been created and built. The second part is applying of Statistical Process Control. And the third part is about the predictive of quality control.

The software development process has been referred in process of built the software inspection. The software of inspection that has been built is using Microsoft Excel Program. This research is involving some testing of inspection to a sample of data. The testing process is about to make sure that the software is reasonable and reliable to use as inspection way.

This study is about the creating of new technology. So that it only involved the data that have been used in testing process of software inspection and also to whom this software inspection will be used. Data that have been using in choosing the forecasting techniques and testing the software are from defect data in Fujitsu Component Bhd.

SIGNIFICANT OF RESEARCH

The research that will be conducted can give the interest and benefits to certain parties. That is:

1. Management of the factories that involved in the production and manufacturing. This industry is involved with the production process and development stages. Much of the process is needed the control of level quality. It is because they have produced the product that will deliver to the customer. Quality is almost important part to the customer. So that, the maintenance of the quality control is most important needed. By this research, the new software of inspection will be produced and the management in the development stages can used it to detect the early defects in order to maintain the quality level.
2. A new approach to apply predictive quality control also will gain. As we known, much of the software inspections technique is used in many industrial and production stages. As together with inside technological development and progress production fields, the new approach is very important in order to make sure the detection of the defects will progress with efficiency.

CONCLUSION

Software inspection is the most important and effective ways in order to predict the level of quality control. Other than that, the new software inspection is needed nowadays because much of the industrial is need the software to make sure the defects can be detects in early stages. So that, the cost of rework the defects can be reduced and the quality also can be maintain

Applying of Statistical Process Control (SPC) in this software are helps to improve processes to enhance the quality and also productivity. this research also

important in produced the new software technique of inspection. The new techniques of inspection is really important because the increasing cost, size, and complexity of software development has led the software engineering community to search for new ways for improving quality and reducing cost through software process improvement. The improvements that have been applied to the software inspection also give more beneficial in inspection process because the new techniques to predict and forecast the quality are used.

REFERENCE

[1] Ackeman, A.F., Fowler, P.J., & Ebenau, R.G. (1984). Software inspections and the industrial production of software. *Proceedings of Symposium Testing - Verification - Alternatives*., Amsterdam, Netherlands, North-Holland Publisher, 13-40.

[2] Ackeman, A.F., Buchwald, L.S., & Lewski, F.H. (1989). Software inspections: an effective verification process. *IEEE Software* ***6***(3), 31-3.

[3] Bordin Sapsomboom, "Shared Defect Detection : The Effects of Annotations in Asynchronous Software Inspection", University of Pittsburgh, 2000

[4] Crosby, P. B. (1979), *Quality is Free: the Art of Making Quality Certain*, McGraw-Hill, New York.

[5] Eberhardt, H., Examples of Inspection requirements and ISO/IEC 17020, ISO REGIONAL WORKSHOP on CONFORMITY ASSESSMENT, 2007

[6] Fagan, M. "Design and Code Inspections to Reduce Errors in Program Development." IBM Systems Journal 15, 3 (1976): 182-211.

[7] Fagan, M. (1976). Design and code inspections to reduce errors in program development. *IBM System Journal* ***15***(3), 182-211.

[8] Fruhauf, K. (1996). Ten obstacles inspections face in an organisation. *Proceedings of the ESA 1996 Product Assurance Symposium and Software Product Assurance Workshop (SP-377), Noordwijk, Netherlands*, ESA Noordwijk Netherlands, 255-8.

[9] Gilb, T. and Graham, D., 1993. Software Inspection. Addison-Wesley Publishing Company.

[10] Harjumaa, L. and Tervonen, I. (1998). A WWW-based tool for software inspection. *Proceeding of the Thirty-first Hawaii International Conference on System Sciences (HICSS'98), Vol. 3*. Los Alamitos, CA: IEEE Press, 379-88.

[11] IEEE, "IEEE 1028-1988: IEEE Standard for Software Reviews and Audits," 1988. Sutherland, J., Devor, R., Chang, T., *Statistical Quality Design and Control.* Prentice Hall Publishing Company, 1992. ISBN: 002329180X.

[12] Juran, J. M. and F. M. Gryna, editors (1988), *Juran's Quality Control Handbook*, fourth edition, McGraw-Hill, New York.

[13] Kelly, J. C., J. S. Sherif and J. Hops, "An Analysis of Defect Densities Found During. Software Inspections", Journal of Systems Software, Vol.17, 1992.

[14] Levinson, W., "Understand the basics of Statistical Process Control", Chemical Engieering Progress , (November 1990).

[15] Marlin, T. E., Process Control: Designing Processes and Control Systems for Dynamic Performance, McGraw-Hill, New York, 2/e (2000).

[16] Nwesri Rodina, "An asynchronous software inspection model", Universiti of Malaya, 2000.

[17] Paulk, M. C., Curtis, B., Chrissis, M. B., Weber, C. V. *Capability Maturity Model for Software, Version 1.1 (CMU/SEI-93-TR-024, ADA 263403).*Pittsburgh, PA: Software Engineering Institute, Carnegie Mellon University,1993.

[18] Shewhart, W. A. (1931), *Economic Control of Quality of Manufactured Product*, D. van Nostrand Company, Inc., Toronto.

[19] Winder, Richard E. and Judd, Daniel K., 1996, ORGANIZATIONAL ORIENTEERING: Linking Deming, Covey, and Senge in an Integrated Five Dimension Quality Model, In ASQC Seventh National Quality Management Conference Transactions. American Society for Quality.

[20] Wheeler, D.A., Brykczynski, B, & Meeson, R.N. (1996). *Software Inspection: An Industry Best Practice*. Los Alamitos, CA: IEEE CS Press.

[21] Montgomery D.C., "Introduction to Statistical Quality Control," John Wiley & Sons Inc. 1985.

[22] Conradi R., Fuggatta A., "Improving Software Improvement," pp. 92-99, IEEE Software No.4, vol 19, 2002.

Space Charging Model As An Effective Management Tool for Lecture Rooms: A Case Study

Ihfasuziella Ibrahim, Wan Zahari Wan Yusoff, Noor Sharipah Sultan Sidi
Department of Construction and Property Management,
Faculty of Technology Management, Business and Entrepreneurship,
University Tun Hussein Onn Malaysia, Johor, Malaysia
Tel : +60139222645, GP090018@siswa.uthm.edu.my, zahari@uthm.edu.my, sharipah@uthm.edu.my

Abstract
The optimization of space management contributes to efficiency and success to the most organisations. Research for space management plays important role to ensure the related organisation will achieve the target of its business goal. This research will determine the space usage for space management in UTHM as a case study and to developed space charging model that will be used. The mechanism used for effective space management will be using qualitative and quantitative approach. A study for actual lecture room used compare the time table provided by the academic management has been done. Information will also be extracted from the quantitative approach where each elements of cost will be compared to the space area used. The operation cost of management such as, electricity, mechanical and civil and other related cost will be determined to get the space tenancy cost from the analysis, level of space usage will be determined whether it was optimum or else. Noted that the space management for institute of higher learning are very critical and therefore, space and facilities management have to be the main agenda and need to be managed efficiently. Maintenance and management costs will be included in a space charging model. It can be used also for charging of rental if the space is not used as intended to. Hopefully, this research may contribute awareness to the users in using the space effectively.

Keyword
Space management, waste of space, space charging model, optimization.

INTRODUCTION

Facilities management is a new field that has a potential growth in Malaysia. This new field of management will contribute to the success of an organisation whether it achieves the set targets and objectives. Through this field, second source of organisation, facilities management can better manage, production and quality will be achieve with workers, users and organisation's customer. This will help the organisation to achieve their objectives [1]. To achieve the organisation's objective, space must be manage effectively. Space management are very important for all organisations especially for higher education institution. Therefore, expenditure is an important thing for real estate management field. Efficient and effective space usage will be control an expenditure cost and level of productivity [2]. According [2] to their study, space management in higher education institutions is more critical compare to other institutions. Therefore, management of space and facilities within an organisation is paramount and must be dealt with efficiently. Implication cost related to physical source in an organisation such as higher education is a great thing to consider. Physical cost is valuable asset which can generate income to an organisation if effectively managed [3]. [4], says that the cost related to the physical sources are the second most important budget after the staff salary in the higher education. All the cost such as maintenance, building, and operation costs cannot be taken lightly. Therefore no space in the university and other organisation should be treated as free [3].

Although institutions of higher learning that they have a shortage of learning space, but [5] explains that most institutions of higher learning institutions are not optimizing the use of physical resources at a specific time such as the use of low on the learning session, not used in the evenings, nights, holidays and semester breaks. It will be a waste of money if the usage of space does not properly or systematically manage. Space management are very important not only for the optimisation but also related to maintenance cost of the respected property. In simple mean, operation cost and maintenance cost will be higher if more space used. As the statement [6] - [7], the space is the catalyst for the costs of other operations. Refer to a case study in UTM Skudai, buildings operation cost for the whole UTM are RM56 million a year. Cost for electricity are 15% from the overall cost [7] totalling RM 8.4 million. Other costs include building operating costs but are relatively cheaper energy costs in these countries than in Western countries, and possibly the cost of energy is less than 15% of the total operating cost of the building. If this assumption is taken into account, the total cost of operating the building will be more than RM60 million per year [3]. Space wastage happened in all higher education institutions including University Tun Hussein Onn Malaysia (UTHM). Average monthly electricity cost for UTHM is RM700, 000.00 or RM8.5 million a year. If more spaces are

being used, then more energy and maintenance costs incurred.

RELATED WORKS

Facilities Management Concept

There are many definitions given to describe the facilities management, which each group and individual try to interpret means of facilities to their own understanding and professionalism [1]. According to IFMA (2005), facilities management is a profession that includes the integration of activities of different disciplines to ensure functionality of the environment with the integration of people, places, processes and technology. British Institute of Facilities Management (BIFM) explains that facilities management is the integration processes between the organizations to maintain and develop the agreed services which support and increase efficiency is the main thing.

Facilities management is a multi-disciplinary activity in developing and managing the environment that affect the people and places of work. Definition of facilities management, and emphasizes that the same trend to create an identity of Facilities Management. The first aspect of the work space, the second role of providing services to support and enable the organization to grow and achieve their core objectives, while the third is as a coordinator to manage human capital, premises, processes and technology in the workplace. As stated by (8), Facilities Management can be defined as the integrated management of the workplace to enhance the performance of an organization.

In Space Charging in Effective Space Management

In a big organisation such as higher education, space management plays very important role because it will give impact to the overall cost for the higher education. [9] Defines a space management proactive management of the research and best practice initiatives to support goals strategic planning and responding to legal requirements. To overcome the space wastage, effective approaches have to be taken. One of the best ways to overcome that problem is to use space charging model. Many facilities experts say that this method is a best management tool. This method was supported by [2] and been certified as the best method in 1996 [2].

[10] Have identified two charges based on operational asset and financial asset. The main purpose of this charge was made to make the user that is not a free space. This is to educate consumers not to use a waste of space. It is to educate user to optimize the usage of the given spaces. Many institution believe that the effectiveness of space charging model can minimize the requirement of space usage and many space will be fully utilize without any wastage [11].

Besides that, space charging can be used as a base for space rental charging. [12], explains that space charging used as based for internal rental to make sure that space usage will cover operational and maintenance cost. He proposed that all space section occupied have to be charge. Four elements in the space charging is first space to be charge, amount to be charge, mechanism for cost and the source of payment for the charge. All this elements is subjected to procedure according to the university laws and regulation. Benefit of space charging model are first, makes the cost of space more transparent, helps overcoming a culture of seeing space as a free good, encourages close examination of how much space is actually needed, enables faculties and departments to take responsibility and make their own decisions regarding how much space is needed and affordable and enables rooms released to be used for other purposes.

Table 1. Institutional Approaches to Space Charging

Institution	Cost Elements
1) Birmingham	• Rate • Insurance • Rent • Planning and administration • Security • Cleaning • Development Division • Utility • Repair and maintenance
2) Keele	• Based on the space provided • The use of computers by students and computer lab • Additional funding • All departments in the scheduling of learning provided • Charge of all space
3) King's College	• The number of students and staff • The first charges in the budget • The difference of time or size • Provision of a budget
4) Sheffield Hallam	• All costs involved in building • All central departments • Based on the actual space used • The actual charge on the budget • Based on the learning space • Service agreed • Space good return, if appropriate • Space and cleaning.

(Source: New Castle University & HEFCE, 2002)

Institutional Approaches to Space Charging

Table 1 below, shows the institutional approaches space charging model as the management tool. They use this method consider with the elements it suitable for their university. It is because each higher education has a different procedures and laws. Higher education in Malaysia is yet to apply this method.

THEORETICAL FRAMEWORK

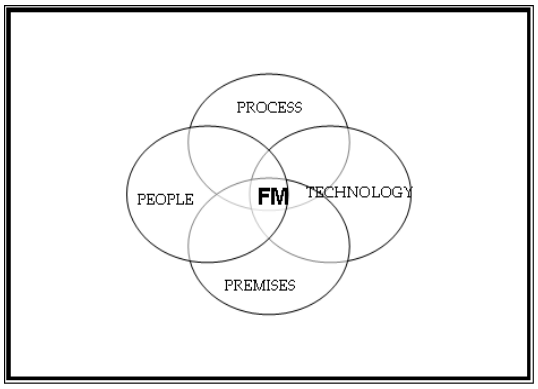


Fig.1.Theoretical Framework

[14] Conclude that all facilities management given before to take all dimension and scope of facilities management. He conclude that facilities management is a profession which covers all type of discipline to make sure work environment can be performed accordingly through human resources, work place, process and technology. Facilities management function are the coordination of four main sources in the organisation that is human, technology, process and premises to form conducive and productive work place. [14] Will be used as basis in the foundation of theoretical framework in this study.

CONCEPTUAL FRAMEWORK

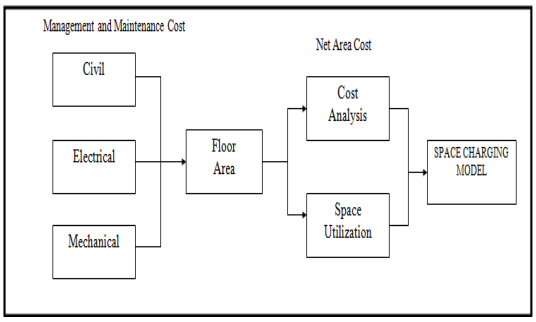


Fig.2. Conceptual Framework

According to [15], space management are the effective way of managing space and to minimized wastage cost and optimized space usage. Efficient space management will increase space usage and reduced operational cost, and make sure that the exactly information space and can use all the facilities and overcome to be good performance. This definition overcomes as a basis to make conceptual framework for this study. There are four aspects in facilities management such as process, technology, people and premises. This study is referring only one aspect it is premises. This is because space management is located under premises. The usage of space must be identified whether it optimized or not. If space usage is under utilization, charge will be taken under space charging model.

SPACE CHARGING MODEL

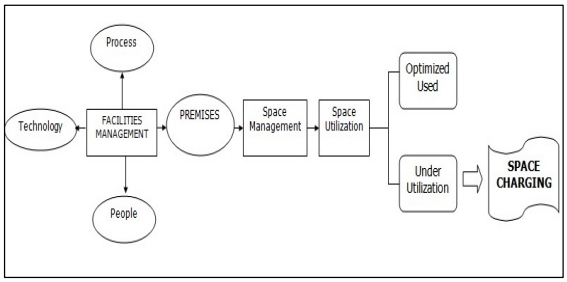


Fig.3. Space Charging Model

Three components to form maintenance cost and management cost is civil, electrical and mechanical. Civil section includes air conditioning maintenance, fire fighting equipment maintenance, influent system, air pressure system and lift system. Electrical section includes electrical maintenance communication system, teaching and equipment system. Mechanical section includes building maintenance, infrastructure, cleaning maintenance, and hygiene maintenance. All these costs will be analysed using formula below. The cost analysis will be divided into class space. This model will be used to charge the unused lecture room or under utilisation space. Besides that, this cost also is the rent of the lecture room. Anyhow this research only focuses for space charging model without considering who to be charge. Therefore it will be the higher education management to decide this matter.

METHODOLOGY

Space management is the most important factor in physical resources management in higher education whether during office hours or after office hours. Since 1960 an organisation have realize the importance of space management [3]. To identify the level usage of studying space, researches used two method of research. The first method is by using field study to examine the lecture room and hall and to audit the usage compare to the time table provided by the Academic Management Office and compare with true usage of the lecture room. Second method is the quantitative methods where

elements of cost will be determine and analyse. The formula used as stated below. Building in block G3 are choose because a lot of lecture are using this particular building and about 3180 accommodating this building.

$$\frac{\text{Total Cost}}{\text{Floor Area Used}} = \$/m^2 \quad (1)$$

Indicator

The formula used to calculate the area under study. The purpose of the use of this formula is to determine whether the class space is used optimally or otherwise.

Capacity Room
A number of maximum students to fulfil the lecture room

Frequency Used

$$\frac{\text{Hours Used}}{\text{Hours Available}} \times 100\% \quad (1)$$

Hours Used = Total hours use
Hours Available = Total hours booked

Frequency Booked

$$\frac{\text{Hours booked}}{\text{Available Hours Book}} \times 100\% \quad (2)$$

Hours booked = Total hours booked.
Available Hours Book =Total hours of available lecture room

Occupancy

$$\frac{\sum \text{Total Students}}{\text{Capacity Room} \times \text{Hours Usage}} \times 100\% \quad (3)$$

Total Students = All students in lecture room
Capacity Room = A number of student to use the lecture room
Hours Usage = Total hours use

Utilization

$$\frac{\text{Room Used Frequency} \times \text{Room Occupancy}}{100} \quad (4)$$

Room Used Frequency = Frequency room can used
Room Occupancy = Room occupancy

Used But Not booked

$$\frac{\text{Hours Used Not Booked}}{\text{Available Booked}} \times 100\% \quad (5)$$

Hours Used Not Booked = Used of lecture room but not booked
Available Booked = Total hours booked

Booked But Not Used

$$\frac{\text{Hours Book not Used}}{\text{Book Hours}} \times 100\% \quad (6)$$

Hours Book not Used = Booked of lecture room but not used.
Books Hours = Total hours booked.

FINDINGS

Audit Graph

The graph in the appendix shows level of occupancy, utilization, frequency used, frequency booked, used but not booked and booked but not used. To measure the level of occupancy, frequency used and frequency booked, which is less than 70% are not meeting the levels of measurement of consumption. However for utilization level, the use of less than 50% is not reached the optimum level of consumption. The above indicator used to determine the level of use in the lecture rooms of G3 Block in UTHM. To the level of frequency booked and frequency used, all classes in learning the building blocks available to achieve the stipulated level of 70% utilization. This means that the frequency of use of space and room reservations is at a satisfactory level. There are 12 classrooms that do not meet the consumption requirements are at levels less than 50% for utilization' s level. This is because the use of the classroom that should be 2 hours but is only used for 1 hour. This shows that there is wasted space because they are not fully used. For the occupancy level, all the classrooms are under 70% because all the lecture rooms did not suit the capacity of the class. For example BKB1 classrooms that can accommodate about 80 people but used only 15 to 74 persons only. For the level of booked but not used, there are 25 classrooms are still not used and there are 16 classrooms which are used but not booked in advance.

Space Charging Calculation

Calculation usage of lecture hall (Lecture Hall A)
Overall cost in UTHM = RM 19,364,133.12
Number of students in UTHM = 7336
Number of students in block G3 = 3180
Total Area block G3 = 8716.250 m^2
Total area lecture hall A = 624.075 m^2

Hours session lecture conducted= 18 jam

Calculation (use the formula above):
RM 19,364,133.12/7336
=RM2639.60…… (1)
3180 X RM 2639.60 = RM 8, 393, 928
(Overall cost for G3 block) .....(2)
RM 8, 393, 928 / 8716. 250 m^2= RM963.02.. (3)
RM 963.02 X 624.075 m^2 = RM 600, 996.71 per year…… (4)
RM 600, 996.71/365 = RM1, 646.57 per day.. (5)
RM 1,646.57/18 = RM 91.48 per hour

Usage cost lecture room per hour

Table 2. Usage cost lecture room per hour

	Space	Charge Per Hour (RM)
1	Lecture Hall A	91.48
2	Discussion Room 01	16.38
3	Lecture Room 1 (BKBI)	16.48
4	Lecture Room 2 (BKB2)	16.48
5	Discussion Room 02	16.38
6	Lecture Room 3 (BKB3)	16.38
7	Lecture Room 4 (BKB4)	16.50
8	Lecture Room 5 (BKB5)	16.48
9	Lecture Room 6 (BKB6)	16.38
10	Lecture Room 7 (BKB7)	16.38
11	Lecture Room 8 (BKB8)	16.50
12	Lecture Room 9 (BKB9)	16.50
13	Lecture Room 10 (BKB10)	16.38
14	Lecture Hall C	35.42
15	Lecture Hall D	23.11
16	Lecture Room 1 (BKEI)	16.38
17	Lecture Room 2 (BKE2)	16.47
18	Lecture Room 3 (BKE3)	16.47
19	Lecture Room 4 (BKE4)	16.38
20	Lecture Room 5 (BKE5)	16.38
21	Lecture Room 6 (BKE6)	16.38
22	Lecture Room 7 (BKE7)	16.38
23	Lecture Room 8 (BKE8)	16.48
24	Lecture Room 9 (BKE9)	16.48
25	Lecture Room 10 (BKEI0)	16.38
26	Lecture Hall F	35.42
27	Lecture Hall G	23.11

DISCUSSION

Overall, there is wasted space in the use of space in the classroom. That lecture room is under occupancy because of the space for lecture room are bigger than total student can occupy. Fewer students should be placed on smaller lecture room to get the optimum space used. While the use of space under utilisation of lectures is due most of the lecturers are not only using the space as the time. Classes should be used for two hours but only used for one hour. Some of the class was cancelled because they already complete the lecture syllabus. This scenario causes most of the lecturers to cancel their classes. This caused contribute to wastage of electric likes, lamp and fan and also for air conditioning because abandoned simply without switch off the system. Waste of space needs to be resolved because it can result in increased operating costs and maintenance of a building. To overcome the problem of wasted space methods of space charging model approach plays a role in determining the charges for the space not fully utilized. The charges to be imposed are depending on the result of space audit which will be done for the respective space. Charges are based on space audit conducted on the space. Spaces are in level under occupancy and level utilisation will impose charge too. However, this study not only allows for the imposition of charges but for internal rent. University can rent this space for outsider for specific purpose. In addition to the imposing charges for space wasted which can generate income for university. This income can be used as university funds.

RESEARCH SIGNIFICANT

This research is generally of interest to various parties such as the management UTHM which can help overcome the problem of waste management space. Similarly, the IPT in other cost elements can be analyzed according to the needs of the university. In addition, it is of interest to the student for the purpose of a guide and reference materials related to this model to solve the problem space. The organization can also apply this model in the management of their space by taking into account the appropriate elements.

CONCLUSION

This study tried to reflect the importance of space management for an organization in achieving its goals and mission of the organization by the students is increasing from time to time. Systematic management of the space could have a positive impact on an organization. Development of space charging model is necessarily the most effective method of overcoming the problem of wasted space when compared with the rules of other management. Therefore, in view of the use of learning space is not used optimally, the higher education will increase efforts so that these facilities can take advantage of various parties including the organisation itself and the country.

ACKNOWLEDGMENT

This work is supported partially by University Tun Hussein Onn Malaysia and the authors would like to thank the supervisor for his ideas and time and also all the support received from relevant parties to the success of this research. Moreover, the authors are also grateful to the anonymous referees for helpful comments and numerous suggestions to improve the paper.

REFERENCES

[1] Abdul Hakim Mohammed, Maimunah Sapri dan Maizan Baba. “Pengurusan Fasiliti”.

Universiti Teknologi Malaysia , Skudai, Johor. (2006).
[2] NAO *Space Management in Higher Education: a Good Practice Guide*, National Audit Office, London. (1996)
[3] Ahmad fauzi A Wahab. "Pengurusan Sumber Fizikal IPT:pengurusan ruang". Universiti Teknologi Malaysia, Skudai, Johor. Dis (2005).
[4] Kenny, G., and K. Foster. "*Managing Space in Colleges"*. FE Staff College. (1985).
[5] Wamer, D., and C. Leonard. "*The Income Generation Handbook"*. Buckingham: SRHE and Open University. Press. (1992).
[6] Lawrence, P. Building Design: More Than Meets the Eye. *The Journal of Business Strategy*. (1989).10: 15-19.
[7] Williams, B. "*Facilities Management. Building"*. Economics Bureau Ltd. UK. (1994).
[8] Tay, L. dan Ooi, J. "Facilities Management: a Jack of All Trades." *Journal of Facilities*. MCB University Press. (2001). Vol. 19.(No. 10). p 357 - 362.
[9] University of Strathclyde Glasgow. "Space Management and Facilities Planning". http://www.strath.ac.uk/estates/space/. (1993)
[10] Cock, R., French, N. "Internal rents and corporate property management", *Journal of Corporate Real Estate*, (2001). Vol. 3 No.3, p.270-85.
[11] Griffith, G. "*Methods of Apportioning Space Related Costs in English Universities*,". Higher Education Funding Council for England, Bristol. (1999).
[12] Weatherhead, M. "*Real Estate in Corporate Strategy"*. Macmillan, Basingstoke. (1997).
[13] Merriam, S. B. "Qualitative Research and Case Study Application in Education." San Francisco: Jossey-Bass. (1998). pp. 26 - 43
[14] IFMA "Definition of Facilities Management." URL.http://www.ifma.org/whatsfm/index.cfm?actionbi g=9 (2005).
[15] Archibus. "Space Management" , Solution for Total Infrastructure and Facilities Management in the World. Boston. (1987).

Design and Analysis of Infinite Reflectarray Antenna

M. Inam, M. Y. Ismail and A. F. M. Zain
Radio Communications and Antenna Design Laboratory (RACAD),
Wireless and Radio Science Center (WARAS),
Universiti Tun Hussein Onn Malaysia (UTHM), Batu Pahat, Malaysia.
muhammad_inamabbasi@yahoo.com

Abstract
This paper provides an effective technique for the realization of infinite reflectarray antenna design. The simulations have been carried out in the X-band frequency range using commercially available computer models of CST Microwave Studio (CST MWS) and Ansoft HFSS. The reflectarray performance has also been discussed based on theoretical equations. Moreover the characterization of losses and the bandwidth performance of rectangular patch element reflectarray have been performed based on Finite Integral Method (FIM) and Finite Element Method (FEM) employed by CST MWS and Ansoft HFSS respectively. The results showed that by varying the material properties of the dielectric substrates, a decrease in reflection loss from 4.326dB to 0.261dB and an increase of 23.3% in bandwidth performance from 126MHz to 540MHz are achievable.

Keywords
Infinite reflectarray, Material properties, Reflection loss, Bandwidth performance.

INTRODUCTION

For most of the radar and long distance communications, the need for high gain antenna is unavoidable. Traditionally, parabolic reflectors or phased arrays have been used for high gain applications. However, the parabolic reflector in many cases, due to its curved surface, is difficult to be manufactured, particularly at high microwave frequencies. It also lacks the ability to achieve the wide-angle beam scanning. On the other hand, the high gain array antenna, when equipped with controllable phase shifters, can achieve wide-angle beam scanning electronically, but generally becomes very expensive due to its complicated beam former and many high cost amplifier modulation systems. As a result reflectarray was introduced in 1963 [1]. However it acquired the attention of the world after the concept of microstrip reflectarrays [2] which eliminates the drawbacks of the conventionally used antennas. A microstrip reflectarray consists of an array of microstrip patch elements printed on a dielectric substrate. The individual elements of the reflectarray are designed to scatter the incident field with proper phase required to form a planar phase surface in front of the periodic array of the aperture [3]. The design techniques commonly used such as identical patches of variable-length stubs [4], square patches of variable sizes [5], and identical planar elements of variable rotation [6] offer a very high efficiency for a very large aperture to be tilted in a large angle. All the above mentioned techniques are used to introduce a small change in the resonant frequency of the individual patch element and hence cause a progressive phase distribution of the reflectarray antenna ranging up to 360° [7]. Deep space exploration and earth remote sensing are few missions of NASA which require high performance antennas with low profile such as reflectarrays in order to extract more information. The reflectarray antennas can also be used in Direct Broadcast Satellites (DBS) and Multi Beam Antenna (MBA) applications.

This paper is based on a fact that infinite reflectarrays can be used to represent a very large finite reflectarray [8]. Hence different types of computer models have been used to design and analyze infinite reflectarrays for their performance improvement.

DESIGN CONSIDERATIONS

Reflectarrays have been designed and analyzed in the X-band frequency range based on different commercially available computer models. The detailed analysis based on Finite Integral Method (FIM), used in CST Microwave Studio and Finite Element Method (FEM) of Ansoft HFSS is presented in this section.

CST Microwave Studio (CST MWS) has initially been used for the simulation of the infinite reflectarray antennas. A reflectarray unit cell patch element has been designed on a substrate material which is backed by a ground plane. The spacing between the adjacent patches of the reflectarray has been taken into account for simulations to avoid the grating lobes. The interelement spacing can be calculated using equation 1.

$$\frac{d}{\lambda_0} \leq \frac{1}{1+\sin\theta} \qquad (1)$$

Where, d is the interelement spacing, θ is the angle of incidence from the feed and λ_0 is free space wavelength. In this design θ has been chosen to be 90 degrees, therefore interelement spacing d should not be greater than $\lambda/2$ in order to avoid grating lobes as shown in

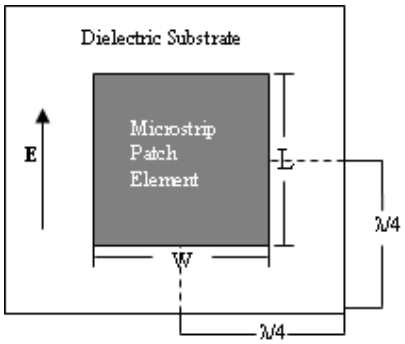


Figure 29. Infinite reflectarray patch element unit cell for fr =10GHz and substrate thickness of 1mm

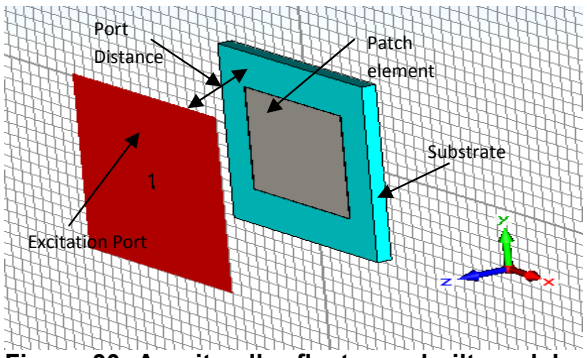


Figure 30. A unit cell reflectarray built model using CST MWS

Figure 1. The unit cell element is excited in the Y-direction perpendicular to the surface of the patch using a waveguide port in CST MWS. In this design the reflectarray length and width are on Y-axis and X-axis respectively as shown in Figure 1.

Figure 2 shows a unit cell reflectarray build model in the CST MWS computer model. The port excitation was kept at a distance of $\lambda_g/4$ from the surface of patch element. Where λ_g, the guided wavelength is given by:

$$\lambda_g = \frac{\lambda_0}{\sqrt{\varepsilon_{reff}}} \qquad (2)$$

λ_g was used because of the effective dielectric permittivity (ε_{reff}) of the material which depends on the height (H) and width (W) of the patch element. Effective dielectric permittivity can be given by the following equation.

$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[1 + 12\frac{H}{W}\right]^{-1/2} \qquad (3)$$

The best basis for the analysis of a very large array is the design of an infinite array. However in a computer model, a reflectarray with an infinite number of elements can not be designed. Therefore proper boundary conditions are used to design a unit cell patch element representing an infinite reflectarray. E-walls are created in the direction of the incident field (Y-axis) and H-walls are created in the direction perpendicular to the incident field (X-axis). This formation creates multiple images of a unit cell and shows the behavior of an infinite reflectarray. In order to apply same concept in Ansoft HFSS which uses FEM, Master and Slave boundaries were used for this purpose where electric field was excited using a Floquet port. Figure 3 depicts the build models of Ansoft HFSS for an infinite reflectarray designed at 10GHz showing Master and Slave boundaries and the Floquet port. Other design specifications were kept same as in CST MWS.

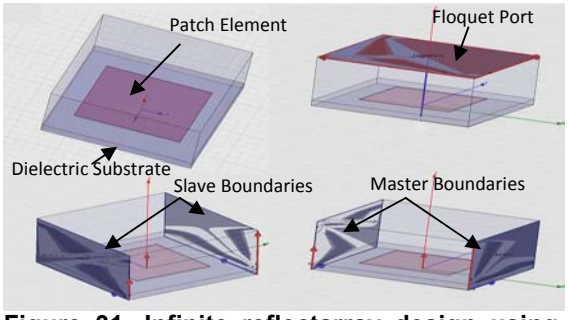


Figure 31. Infinite reflectarray design using Ansoft HFSS

ANALYSIS FOR DIFFERENT DIELECTRIC SUBSTRATES

In order to validate the settings of both the computer models of CST MWS and Ansoft HFSS, an infinite reflectarray was designed at 10GHz using Teflon (ε_r=2.08, tanδ=0.0004) as the substrate material. Figure 4 shows the reflection loss and reflection phase curve of an infinite reflectarray antenna designed with Teflon. It can be observed that the results obtained by both the computer models are in close agreement. Moreover the reflectarray designed with Teflon gives a reflection loss of 0.055dB at 10GHz and a smooth phase curve with a total phase range of almost 300°. The phase curve can also be used to depict the bandwidth of a reflectarray. The smoother the curve, the larger will be the bandwidth [3].

In order to compare different performance parameters, various substrate materials have been used to design reflectarray antennas in the X-band frequency range. The summary of the reflection loss performance of reflectarrays printed on different dielectric substrates is shown in Table 1. It can be observed from Table 1 that the reflection loss depends on the dielectric permittivity as well as the loss tangent of the substrate materials. The highest loss is produce by CEM (ε_r=4.5, tanδ=0.025) because of the highest dielectric constant and loss tangent value among the materials used in the investigation.

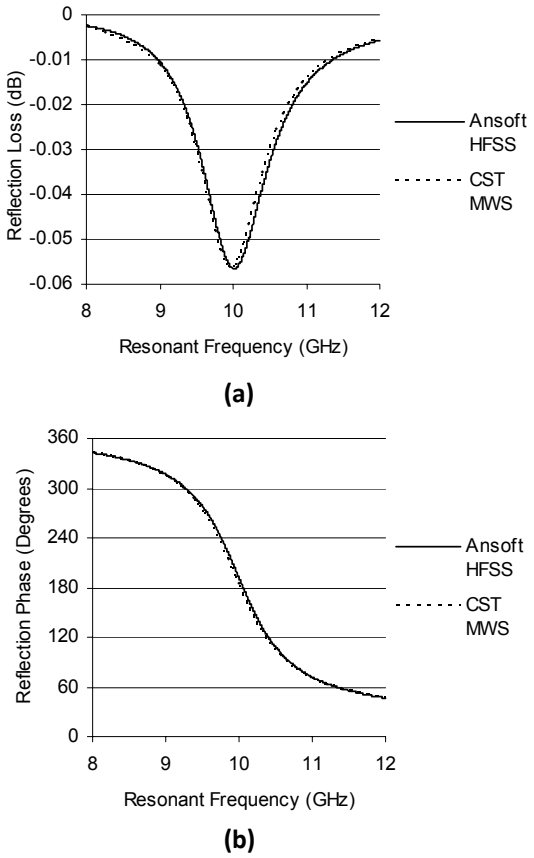


Figure 32. (a) Reflection loss curve (b) Reflection phase curve for a reflectarray designed at 10GHz

Table 12. Reflection loss of different substrate materials used for reflectarray design

Material	ε_r	Tanδ	Reflection loss at Fr=10GHz
Vaseline	2.16	0.001	0.261 dB
Roger 5880	2.2	0.0004	0.180 dB
Roger 5870	2.33	0.0012	0.313 dB
CEM	4.5	0.025	6.875 dB
Beryllia	6.5	0.0004	0.395 dB
Alumina	9.75	0.0003	0.519 dB
Silicon	11.9	0.004	2.857 dB
Gallium Arsenide	13	0.006	4.326 dB

The 10% and 20% bandwidth is measured by moving 10% and 20% above the reflection loss at 10 GHz and as listed in Table 2. The difference in reflection phase curves is also observed and in order to compare the reflection phase performance, a figure of merit (FoM) [9] has been defined as the ratio of the change in reflection phase to the change in the frequency and can be expressed as in equation (4).

$$FoM = \frac{\Delta\phi}{\Delta f}\left(^\circ / MHz\right) \qquad (4)$$

Where $\Delta\Phi$ is the change in the reflection phase and Δf is the change in the resonant frequency of the reflectarray antenna and FoM is calculated here in °/MHz. The bandwidth and FoM calculated in this work for the different materials are presented in Table 2. From Table 2, it can be observed that Gallium Arsenide has the minimum 10% and 20% bandwidths of 84 MHz and 126 MHz respectively and the highest FoM of 0.759°/ MHz while Teflon has the highest 10% and 20% bandwidths of 360 MHz and 540 MHZ respectively and has lowest FoM of 0.209°/MHz. The reason for this behaviour of different substrates is the difference in material properties. Higher dielectric permittivity materials show lesser bandwidth as compared to the lower dielectric constant substrates. However the total phase range in the case of higher dielectric materials is observed to be better.

Table 13. Bandwidth and FoM for Different Materials

Dielectric Material	10% Bandwidth (MHz)	20% Bandwidth (MHz)	FoM (°/ MHz)
Teflon	360 MHz	540 MHz	0.209 °/ MHz
Vaseline	358 MHz	534 MHz	0.215 °/ MHz
Roger 5880	344 MHz	520 MHz	0.218 °/ MHz
Roger 5870	322 MHz	490 MHz	0.228 °/ MHz
CEM	218 MHz	285 MHz	0.386 °/ MHz
Beryllia	155 MHz	239 MHz	0.457 °/ MHz
Alumina (95%)	110 MHz	167 MHz	0.581 °/ MHz
Silicon	89 MHz	131 MHz	0.715 °/ MHz
Gallium Arsenide	84 MHz	126 MHz	0.759 °/ MHz

CONCLUSION

From the work demonstrated in this paper, it can be concluded that infinite reflectarrays can be effectively designed using proper boundary conditions in different commercially available computer models. Moreover different performance parameters of reflectarrays can be improved by utilizing material properties. Reflection loss can be reduced by using low dielectric materials which also improves the bandwidth performance. However the trade-off between bandwidth performance and total phase range is unavoidable for single layer design. Therefore the selection of material for reflectarray design should consider the needs of a particular application.

ACKNOWLEDGMENT

This research is fully funded by the Fundamental Research Grant Scheme (FRGS), Ministry of Higher Education Malaysia (VOT 0558). We would like to thank the staff of Radio Communications and Antenna Design (RACAD) laboratory of Universiti Tun Hussein Onn Malaysia (UTHM) for the technical support.

REFERENCES

[1] G. D. G. Berry, R. G. Malech and W. A. Kennedy, IEEE Trans. Antennas Propag., Vol. AP-11, (1963) 645-651.

[2] J. Huang, IEEE AP-S/URSI Symposium Digest, London, Ontario, Canada, (1991) 612-615.

[3] D. M. Pozar, S. D. Targonski, and H. D Syrigos, IEEE Trans. Antennas and Propagation, Vol. 45, No 2, (1997) 287-296.

[4] S. D. Targonski and D. M. Pozar, IEEE AP-S/URSI Symposium, Seattle, Washington, (1994) 1820-1823.

[5] R. D javor, X. D. Wu, K. Chang, IEEE Trans. Antennas and Propagation, Vol 43, No 9, (1995) 932-938.

[6] J. Huang and R .J. Pogorzelski, IEEE AP-S Symposium Digest, (1993) 1280-1283.

[7] M. Y. Ismail, M. Inam and A. M. A. Zaidi, American J. of Engineering and Applied Sciences 3 (1) (2010) 180-185.

[8] P. W. Hannan and M. A. Balafour, IEEE Transactions on Antenna and Propagation, Vol. 13, Issue 3, (1965) 342-353.

[9] M. Y. Ismail and M. Inam, Modern Applied Sci. J. CCSE., Vol. 4, No. 1, (2010) 28-35.

Effect of Ageing Time Bismuth Titanate Synthesis via Modified Hot Injection Method

Siew Ling Lee[1]*, Shih Ween Yong[1] and Hartini bt Khairi Osman[1]
[1] Ibnu Sina Institute for Fundamental Science Studies, Universiti Teknologi Malaysia, 81310 UTM, Skudai, Johor, Malaysia
*sllee@ibnusina.com.my

Abstract
Polycrystalline bismuth titanate, $Bi_{12}TiO_{20}$ compound was synthesized for the first time via hot injection method. During the synthesis process, titanium butoxide was injected into a hot solvent which consisted of bismuth nitrate and nitric acid as the solvent at 130°C. The rapid injection of titanium precursor into the hot solvent at 130°C resulted in a very fast nucleation, followed by the growth of nuclei at low temperature. The crystal growth of the compound was measured and observed during interval time of 12 hours and 20 hours. The synthesized compound was characterized using XRD and FESEM for. A single phase compound was obtained after heating at 650˚C for 20 hours crystalline growth compared to the 12 hours crystalline compound where it observed as a mixed phase was detected.

INTRODUCTION

Bismuth titanate, $Bi_{12}TiO_{20}$ is a Bi containing and Ti based compound which can be used mainly as a photocatalyst. Recently it is one of the most often investigated sillenites because of its amazing properties such as high electrooptical coefficient, low optical activity and high photosensitivity in the visible region which makes the compound useful as a photocatalyst. So far, the compound was synthesized by solid state reaction, hydrothermal reaction and also co-precipitation. Here, Bismuth titanate was synthesized for the first time using the hot injection method. The hot injection method requires short duration of synthesis and produces high crystalline polycrystalline. The ageing time for the synthesized of bismuth titanate of the compound was investigated.

EXPERIMENTAL

Synthesis of $Bi_{12}TiO_{20}$

Bismuth Titanate was synthesized using the modified hot injection method. Bismuth nitrate, $Bi(NO_3)_3.5H_2O$ was used as the bismuth precursor and titanium butoxide, $C_{16}H_{36}O_4Ti$ was used as the titanium precursor. 6M of nitric acid was used to dissolve bismuth nitrate. The mixture was then added with n-n-dimethylformamide followed by oleic acid as a surfactant. The mixture was then preheated at 130˚C for 30 minutes. After that, titanium precursor was injected into the mixture and was left for 2 hours. After 2 hours, the mixture was left in room temperature for crystal growth at 12 hours and 20 hours. The precipitate was then filtered and wash with cold ethanol, followed by drying in the oven. The powder was then collected and sent for heating at various temperatures.

Characterization

In characterizing the materials synthesized, several instruments were used. The phase identification of the products was accomplished by using powder X-Ray Diffraction (XRD) employing a Siemens D5000. A scan rate of 0.05˚ was applied to record pattern in 2θ range of 10-90˚. The images of the products were captured by the JEOL – JSM – 6701F field emitting scanning electron (FESEM).

RESULT AND DISCUSSION

Physical properties of bismuth titanate

It was observed that the synthesized bismuth titanate materials with crystal growth time of 12 hours and 20 hours were bright yellow powder under the calcinations until 650˚C.

XRD results for bismuth titanate

The powder X-ray diffractions pattern of $Bi_{12}TiO_{20}$ samples treated at various temperatures are shown in Figure 1 which is for 12 hours and Figure 2 for 20 hours. Only single phase of $Bi_{12}TiO_{20}$ was found matching to the sample with 20 hours crystal growth timing. A perfect crystallinity of cubic $Bi_{12}TiO_{20}$ was obtained under the calcinations of 650˚C for 20 hours crystal growth. A longer ageing time in the synthesis will encourage the formation of single phase crystalline and also a proper homogenized compound before heating treatment. Obtaining a single phase crystalline can also be obtained at lower temperature.

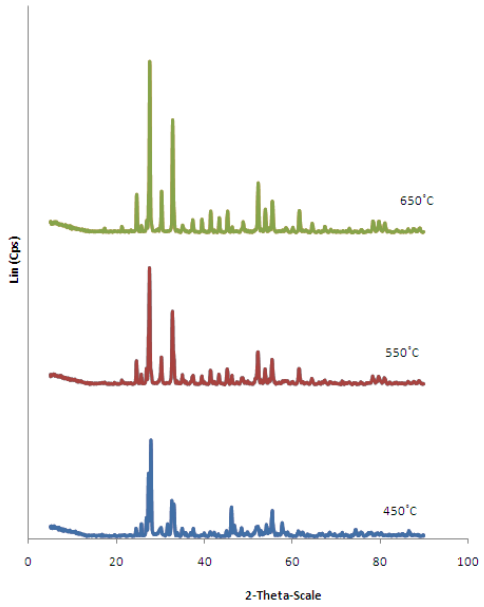


Figure 1. XRD pattern of bismuth titanate heated from 450˚C to 650˚C and 20 hours ageing time

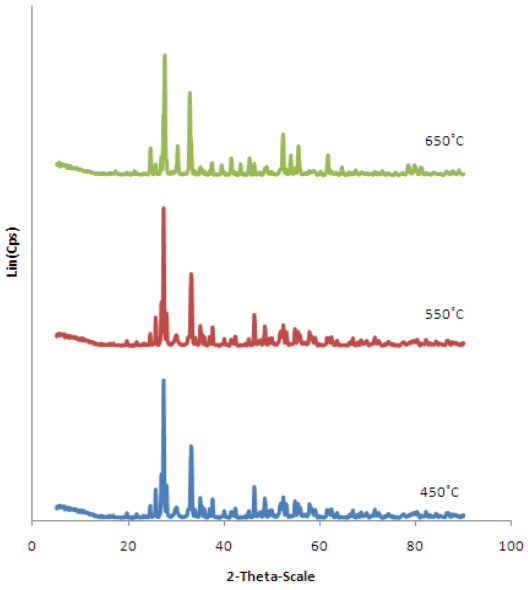


Figure 2. XRD pattern of bismuth titanate heated for 450˚C to 650˚C and 12 hours ageing time

FESEM morphology of bismuth titanate

Figure 3 shows the morphology of bismuth titanate compound which was heated at 650˚C and the aging time for crystal growth is 20 hours. It can be seen that the morphology of the compound was in different shape and it is in bulk. It also shows sintering effect where the particles were all merge together. The surface of the compound was not homogenized and inconsistent in shape

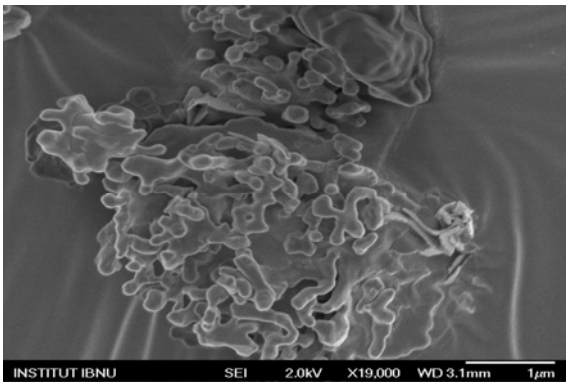


Figure 3. FESEM image of bismuth titanate heated for 650˚C and 20 hours aging time

The morphology of bismuth titanate compound which was heated at 650˚C where the crystal time growth was at 12 hours is being investigated.

CONCLUSION

It can be concluded that the most suitable ageing time for bismuth titanate was 20 hours which gives single phase compound. The ageing time 12 hours for the synthesis shows that there are mixed phase in the compound which consists of Bi_2O_3 and $Bi_{12}TiO_{20}$. However heating temperature at 650˚C shows sintering effect for the ageing time of 20hours.

ACKNOWLEDGEMENT

Financial support of Fundamental Research Grant Scheme from Ministry of Higher Education Malaysia (vote research 78334) was acknowledged.

REFERENCES

[1] Li, L., ProtiÃ¨re, M., & Reiss, P. Economic Synthesis of High Quality InP Nanocrystals Using Calcium Phosphide as the Phosphorus Precursor. *Chemistry of Materials, 20*(2008), 2621-2623.

[2] Williams, J. V., Kotov, N. A., & Savage, P. E. A Rapid Hot-Injection Method for the Improved Hydrothermal Synthesis of CdSe Nanoparticles. *Industrial & Engineering Chemistry Research, 48*(2009), 4316-4321.

[3] Yao, W. F., Wang, H., Xu, X. H., Zhou, J. T., Yang, X. N., Zhang, Y. Photocatalytic property of bismuth titanate Bi2Ti2O7. *Applied Catalysis A: General, 259*(2004), 29-33.

[4] Zhou, J., Zou, Z., Ray, A. K., & Zhao, X. S. Preparation and Characterization of Polycrystalline

[5] Bismuth Titanate Bi12TiO20 and Its Photocatalytic Properties under Visibleight Irradiation. *Industrial & Engineering Chemistry Research, 46*(2007), 745-749

Parametric Analysis of Natural Gas Dehydration via Solid Phase Adsorbent with Copper Catalyst

N.N. Amran[1,*], A.M. Shariff[1,] and K.K. Lau[1]

[1] Department of Chemical Engineering, Universiti Teknologi PETRONAS, Tronoh, Perak, Malaysia.
(E-mail: *nurulnajmin@gmail.com*; azmish@petronas.com.my; laukokkeong@petronas.com.my)

Abstract

Gas dehydration is the main concern in the natural gas industry. Natural gas can combine with liquid or free water to form solid hydrates, water can condense causing corrosion in the pipeline and water vapor decreases the heating value of the gas. The most common technology used to remove water from gas is TEG (Triethylene Glycol) technology which gives various problems related to its operation and requires large space, frequent monitoring, and a lot of maintenance, thus undesirable for offshore application. This paper illustrates an alternative dehydration process, adsorption using zeolite with Copper catalyst, which gives better or at par separation efficiency compared to glycol dehydration process and reliable for offshore applications and requires less monitoring, less maintenance and the foot print area is at a premium.Copper catalyst has been proven to be a ble to enhance the zeolite's performance in gas separation because of its high activity and selectivity features. Zeolite mixed with Copper catalyst potentially gives a better selectivity and adsorption performance as compared with zeolite alone. In this work, mixing ratio of copper catalyst and zeolite, regeneration of copper catalyst, and type of packing were evaluated for separation of water vapor from methane.

Keywords

Adsorption Equilibrium, Copper Catalyst, Dehydration process, Dynamic Adsorption, Zeolite.

INTRODUCTION

With the remarkable development of processing industries in recent years, natural gas has been very used very frequently and abundantly. In addition, with enhanced degree of energy source, the requirement for higher purity of natural gas becomes increasingly strapping. The current status of primary energy sources used is shown that dry natural gas is on a par with coal consumption, making it as the second largest energy resource after petroleum [1]. It is estimated to be the fastest growing by 2020 where as the world's consumption is projected to be 172 trillion cubic feet and is likely to increase demand in a huge market for the production, transportation and sale of gas [2].

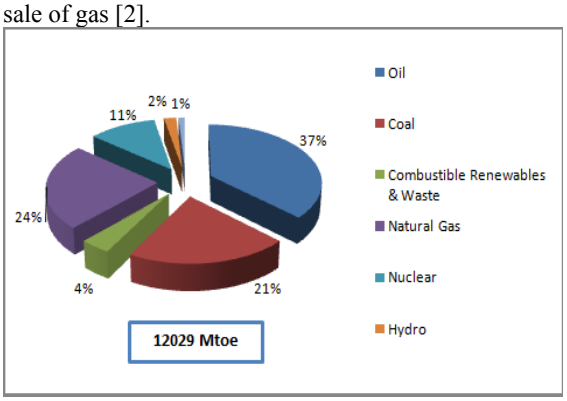


Figure 33: World Primary Energy Supply, 2008 (data from the IEA Key World Energy Statistic, 2009)

Under such a circumstance it is desired to highly purify natural gas by efficiently removing such impurities as water (H_2O), carbon dioxide (CO_2), hydrogen sulfide (H_2S), solids and free liquids to acceptable levels or less in high safety and efficiency at low installation and running costs.

The dehydration of natural gas is important process because with the presence of water vapor in concentrations above 100 of parts per million has potentially disastrous consequences [3]. Water may form hydrates, thus can reduce pipeline flow capacities. Furthermore, water will formed corrosive solution that will corrode the pipeline in the presence of carbon dioxide. There are several methods for the dehydration of natural gas which are absorption, adsorption by solid, membrane permeation, refrigeration and supersonic.Three main challenges in developing dehydration new technologies includes space and weight savings especially from compact equipment design, reliability of equipment performance and minimum maintenance and less monitoring.Among these methods, dehydration by adsorption has more popularity in industrial units because of its better efficiency and the merit of continuity and the low cost of construction and maintenance.

Molecular sieves are frequently used for the drying and purification of gas. Molecular sieves also known

as zeolite adsorb more strongly than either silica gel or clay due to their relatively high adsorbate binding energies, short mass transfer zones, and enabling to adsorb capacity of water to a very low product water concentrations. Numerous studies of water vapor adsorption can be found in the literature [4-6]. Copper catalyst mixed with zeolite has been studied to dehydrate water vapor from natural gas and it is proven that the bonds of physical adsorption gives stronger than van der Waals interactions thus giving rise to higher selectivities.

In this work, we evaluated the performance of four different adsorbents to remove water at temperature 323K with high pressure which is following the operating condition on offshore application. The objective of the work is study the characterizations of some potential adsorbents to determine its properties and behaviors evaluated using nitrogen adsorption. Adsorption equilibrium on these zeolites were analyzed with gravimetric method. Dynamic adsorption study were determined by performing parametric study to investigate the factors influencing the separation efficiency of natural gas dehydration under adsorption process with/out the aid of copper catalyst.

METHODOLOGY

Four types of commercial adsorbents (Zeolite type) have been identified after the initial screening (3A, 4A, 5A and 13x). In order to identify the best coalescer material, the performance of these materials have been evaluated through nitrogen physical adsorption, adsorption equilibrium using Magnetic Suspension Balance (MSB) and dynamics adsorption study of water vapor using Coalescer Performance Evaluation test rig.

Nitrogen Adsorption

Crystalline adsorbent materials selected for this study and all these zeolite were provided by ZeoChem. Nitrogen adsorption tests were performed to obtain BET surface area, pore volume, and the pore characteristics of solid materials using a Micrometrics ASAP 2000 gas analyzer. 0.15 g adsorbents were used for each analysis and loaded into blank sample tube. The samples degassed at 423K and evacuated to 500mmHg for 12 hours to remove impurities and moisture content inside. After degassing, the samples were analyzed until adsorption-desorption isotherm were obtained.

Adsorption Equilibrium

The adsorption isotherm were obtained used gravimetric method to predict the total adsorbed amount by a simple flow apparatus, in which the sample is sealed off, disconnected and weighted after the equilibrium is reached. Magnetic Suspension Balance (Rubotherm, Germany) gravimetric method is preferred for adsorption isotherm since it can produce accurate result. For each isotherm, approximately 2 g of adsorbent were placed in a basket suspended by the permanent magnet of balance. The balance was then closed with a jacketed cell, and the temperature inside thus cell was controlled by a thermostatic circulating bath (Lauda, Germany). During adsorption, the temperature was conducted at 50^{o}C and pressures up to 80barg. A schematic diagram of Rubotherm gravimetric adsorption measurement unit can be seen in Figure 2.

Dynamic Adsorption

The main purpose of the dynamic study is to investigate the effect of inlet pressure, temperature, mixing ratio of copper catalyst and zeolite, regeneration of copper catalyst, and type of packing on the separation efficiency of adsorption process for natural gas separation and dehydration.

Only the best adsorbent selected from adsorption isotherm was used in this study to be mixed with copper catalyst. The column dimensions and the experimental condition are given in Table 2. The dynamic adsorptions were determined on an experimental setup schematically represented in Figure 3. The experiments were performed using a ½ inch stainless steel column, saturation vessel containing water to saturate with hydrocarbon, eliminated with heating element along the pipeline to control the adsorption temperature

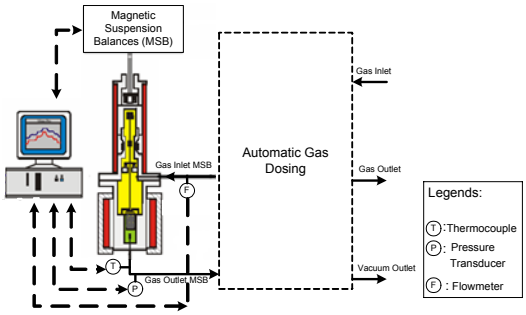


Figure 2: Schematic diagram used in the determination of the adsorption isotherms.

Table 14: Conditions of Dynamic Adsorption Experiments

Parameters	Zeolite 13X with Copper catalyst	
Mass of adsorbent (g)	8	
Bed diameter (cm)	1.3	
Bed Length (cm)	10	
Inlet water concentration (ppm)	1400	
Flow rate (l/min)	5	
Temperature (K)	323	
Pressure (kPa)	8000	
Mixing Ratio (%)	20/80	50/50
Type of packing	Alternate	2 Layers

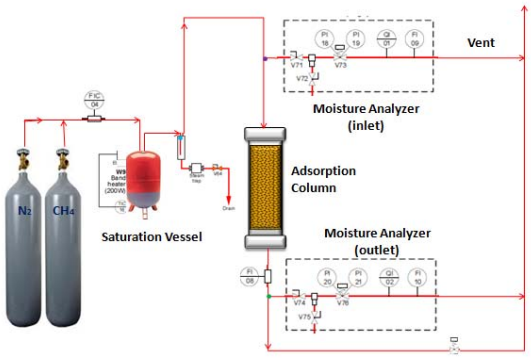


Figure 3: Schematic diagram used in the determination of the dynamic adsorption.

RESULTS AND DISCUSSION

The results of this work consist with three major parts. The first part is to identify the type of the adsorption isotherm and surface are of the samples, the second is to analysis the amount adsorbed of water vapor while the third is to evaluate the dynamic adsorption with the difference condition parameters.

The Nitrogen adsorption isotherm at 77K, presented in Fig. 4 and relative pressure (P/Po) ranging from 0.05-0.9. According to the definition of Brunauer the zeolites 3A, 4A, 5A and 13X are characterized by type I isotherms. These zeolites shows the curve raised almost vertically, nearly horizontal section and bulk condensation is begin to occur at the end of adsorption. Micropore filling takes place in that process and covered by monolayer adsorption indicates to Langmuir type adsorption isotherm. From Table 2, it can be seen that the amount of adsorbed nitrogen for Z-13 is highest at the same relative pressure and has the highest surface areas of several hundred $m^2.g^{-1}$ as well as the values of micropore volume and pore area.

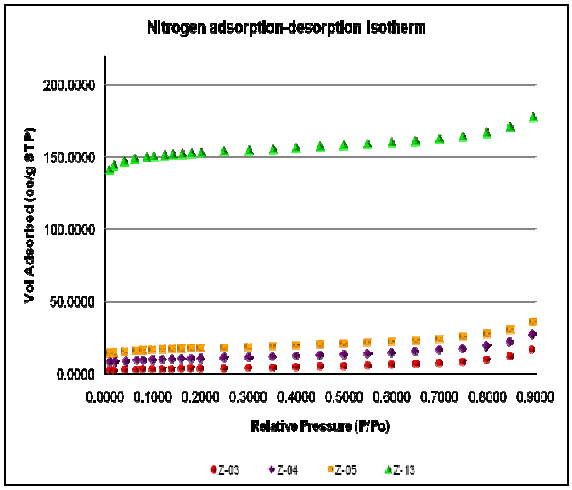


Figure 4: Nitrogen adsorption isotherm at 77K for 3A, 4A, 5A and 13X zeolite.

In the equilibrium-based adsorption studies, information obtained from the adsorption isotherm is very crucial for adsorbent selection. The adsorption isotherm for CH_4 and H_2O on 3A, 4A, 5A and 13X zeolite are shown in Figure 5 and 6 respectively. For all adsorbents, the adsorption capacity of H_2O is higher than CH_4 A comparison between all the adsorbents shows that 13X zeolite has the biggest capacity for both CH_4 and H_2O. The adsorbent capacity increases as the surface area of adsorbent increases.

Table 2: Physical features of the zeolites

Adsorbent	BET surface area (m^2 /g)	Pore opening for single point (Å)	Micropore volume (cc/g)
Z-03	38.82	3.2	0.0073
Z-04	65.98	3.8	0.0171
Z-05	528.35	5	0.1150
Z-13	593.82	9	0.2180

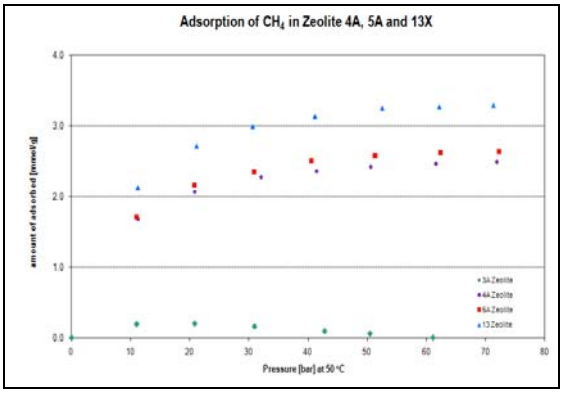


Figure 5: Adsorption isotherm of methane at 323 K for 3A, 4A, 5A and 13X zeolite.

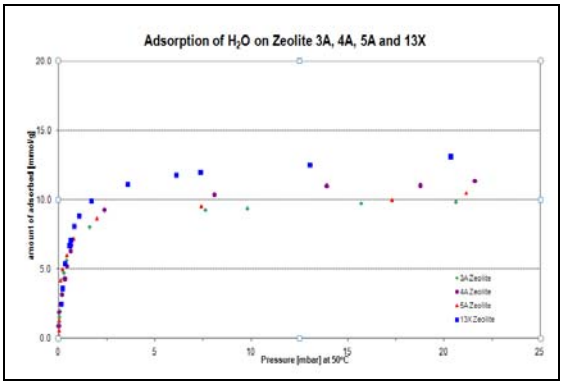


Figure 6: Adsorption isotherm of water vapor at 323 K for 3A, 4A, 5A and 13X zeolite

From the curves shown it can be observed that the adsorption capacity decreases at high pressure. This is due to the fact that three distinct mechanisms contribute to the adsorption of water vapor on zeolite. At low pressures, water molecules chemisorb to the

surface of the adsorbent. At intermediate pressures, water molecules physisorb on the already chemisorbed molecules, and at higher pressures, capillary condensation occurs within the mesopores and the smaller macropores.

There are two forces involved in physical adsorption namelt van der Waals and electrostatic forces. Van der Waals force is always present in any adsorbent-adsorbate system while electrostatic force is only present in adsorbent which has ionic structure such as zeolite [7,8]. The adsorption of H_2O is higher than CH_4 for all adsorbents. This phenomenon can be explained from the forces involved in the physical adsorption. Zeolite adsorbents have highly polar surface that tends to attract polar molecules due to electrostatic forces. Since H_2O has higher polarity compared to CH_4, therefore H_2O is more strongly adsorbed.

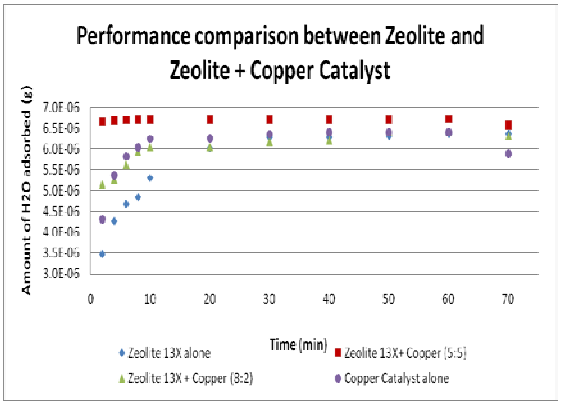


Figure 7: Dynamic adsorption between zeolite 13X and zeolite 13X mixed copper catalyst with different ratio at 323 K and pressure at 8000kPa.

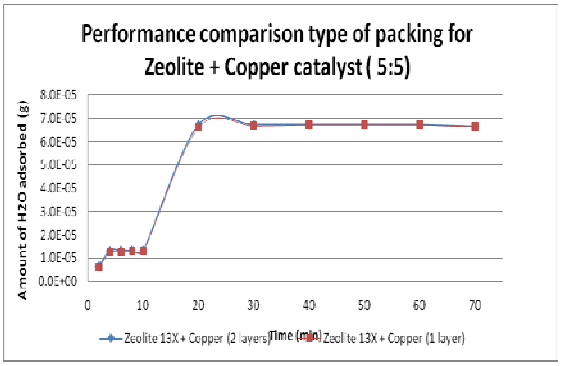


Figure 8: Dynamic adsorption for zeolite 13X on different type of packing at 323 K and pressure at 8000kPa

In dynamic adsorption, zeolite 13X has been selected based from adsorption equilibrium result which had shown the highest adsorption capacity for water vapor compared to the others zeolites. In order to enhance the dehydration capability, copper catalyst has been added with zeolite 13X. Based on the study conducted, we have performed various experiments which are mixing ratio between zeolite and copper catalyst, varying the type of packing and regeneration process. From Figure 7, the performance comparison for mixing ratio of zeolite 13X and copper catalyst shows that 5/5 ratio gives highest amount absorbed water and fastest rate of adsorption at low partial pressure. From this result, we found that copper catalyst had bind chemically with other types of coalescer materials. Copper also is particularly can interact with CO, O_2 and H_2O which are more strongly than Ag+ also for economic basis due to the high density of copper to lower the volume size of column [7, 9, 10]. The type of packing layer experiment shows in Figure 8. Based on the result the performance is about the same and it is merely gives 1% increment difference due to the interaction between the copper and zeolite give the maximum amount adsorption and would not give any effects performance if the packing layer is changed. Regeneration process experiment was repeated several times to evaluate the lifetime of copper catalyst. Consequently, experiment before and after regeneration is also about the same performance. It is shows that the copper catalyst can be used over again after regeneration once it is saturated with water. The result for regeneration process of copper catalyst represented in Figure 9.

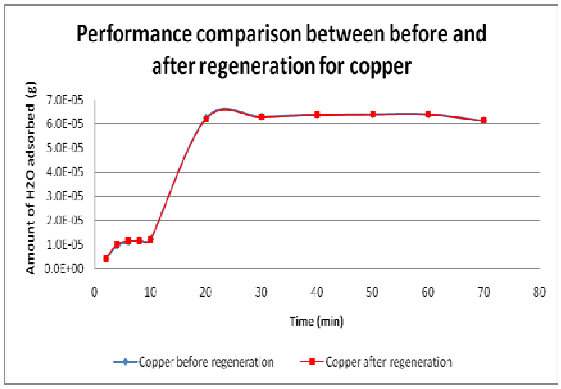


Figure 9: Regeneration process before and after for copper catalyst.

CONCLUSION

We have characterized a series of micropores zeolites by using physical gas adsorption method. This method is frequent considered as a first choice technique to identify the surface area, pore characteristics and pore volume. We have found that Z-13X has the highest surface area, micropore area and micropore volume, indicating the possibility of application for efficient catalytic materials.

Adsorption isotherm studies for several commercial zeolites have been conducted. Based on the study, the water vapor has high affinity to be absorbed by the zeolites as compared to methane because of its polarity

and smaller size. Zeolite 13 X shows the highest adsorption of methane and water vapor as compared to other zeolites tested. Hence, this zeolite has been chosen to be mixed with Copper catalyst to enhance the adsorption performance. Zeolite 13 X (with ratio 5/5) shows the highest adsorption capacity of water vapor. Alternate layer merely gives 1% of increment in term dehydration performance. The dehydration capacity for copper catalyst remained the same after regeneration.

ACKNOWLEDGMENTS

The author gratefully acknowledges the support from the Department of Chemical Engineering Universiti Teknologi Petronas and Petronas Carigali SDN BHD-Sarawak Operations for funding the project, A.P Dr. Azmi M Shariff as main supervisor and Dr Lau Kok Keong as co-supervisor

REFERENCES

[1] E. I. Administration, "Key World Energy Statistic 2009," 9, rue de la Fédération 75739 Paris Cedex 15: International Energy Agency, 2009.

[2] E. I. Administration, "International Energy Outlook 1998," Washington, DC, April 1998

[3] A. J. Kidney and W. R. Parrish, *Fundamentals of Natural Gas Processing*. Columbus, Ohio: Taylor and Francis, 2006.

[4] M. Blachman and T. McHugh, "Sour Gas Dehydration Technology and Alternatives," in *LRGC* Norman, Oklahoma, 2000.

[5] P. Gandhidasan, A. A. Al-Farayedhi, and A. A. Almubarak, "Dehydration of Natural Gas using Solid Desiccant," *Energy,* vol. 26, pp. 855-868, 28 April 2000.

[6] J.-H. Kim, C.-H. Lee, W.-S. Kim, J.-S. Lee, J.-T. Kim, J.-K. Suh, and J.-M. Lee, "Adsorption Equlibria of Water Vapor on Alumina, Zeolite 13X, and a ZeoliteX/Activated Carbon Composite," *Chem Enginering Data,* vol. 48(1), pp. 137-141, 2002.

[7] R. T. Yang, *Adsorbent: Fundamentals and Applications*. New Jersey: John Wiley and Sons, 2002.

[8] D. M. Ruthven, *Principle of Adsorption and Adsorption process.* New York: John Wiley and Sons, 1988.

[9] G. Deckers and G. Horn, "Copper Catalyst," in *United States Patent* Germany, 1993.

[10] B. O. Krueger, "Removal of Oxygen from Gas Stream with Copper Catalyst," in *United States Patent* Columbus, Ohio, 1975.

A System Architecture for VANET Applications

Maythem K. Abbas[1], M. N. Karsiti[1] and Madzlan. Napiah[2]
[1] Department of Electrical and Electronic Engineering, Universiti Teknologi PETRONAS, Tronoh, Perak, Malaysia.
[2] Department of Civil Engineering, Universiti Teknologi PETRONAS, Tronoh, Perak, Malaysia.
E-mail: eng_maythem_84@yahoo.com; nohka@petronas.com.my, madzlan_napiah@petronas.com.my)

Abstract
Car manufacturers are about to take a quantum leap in terms of enhancing driving safety and comfort but they are waiting for new technologies and applications to be created and experimented so they can use with their products. In this paper, we are proposing a system design and show how it would be setup and to be used by other researchers. In addition, we (orally) going to illustrate 3 case studies; balancing the road traffic load and make the driving on highways and urban cities roads more comfort, Vehicles speed remote control, and theft vehicles remote control. Initially, the system has five main devices which would co-operate together to provide safety, assistance, and comfort for the drivers. Our system architecture can be an important and a unique part of the future leap. By applying this system on highways and cities roads, we expect to see an easy traffic flow, more efficient and comfort driving and less air pollution.

INTRODUCTION
Vehicular Ad-Hoc Network (VANET) is a form of Mobile Ad-Hoc Network, originally was used to provide safety and comfort for passengers, and currently being used to establish dedicated short range communications (DSRC) among nearby Vehicles (V2V Communications) and between vehicles and nearby fixed infrastructure equipments; Roadside equipments (V2I Communications). VANET was used also to warn drivers of collision possibilities, road sign alarms, Auto-payment at road tolls and parks…etc. Usually VANET can be found in ITS (intelligent transportation Systems).[24]

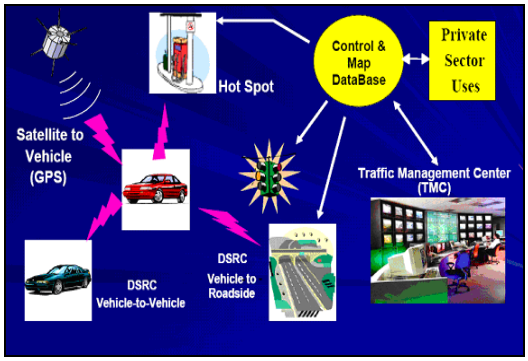


Figure 1. VANET Integrated Infrastructure

The VANET ideally works in an integrated environment that shown in Figure 1.[7] In this project, VANET was employed to help in traffic management and ease the traffic flow.

Objective Of The Study
The main objective is creating a system's architecture and based on that architecture, a collection of algorithms (a protocol) would be created that can be utilized on roads to make it more efficient in terms of traffic flow.

Scope Of The Study
The suggested system's architecture has five main devices; Coordinator Device (Co_D), Road Side Equipments (RSE), Traffic-Light Controller (TLC), VANET Road-Belt (VRB)[19], and Vehicle VANET Device (VVD). The VVD can be programmed by authorized people to act as a Police VANET Device (PVD), Fire-Fighting VANET Device (FVD), Ambulance VANET Device (AVD) and Civilian vehicle's VANET Device (CVD). Based on the suggested architecture a set of algorithms would be created to balance the traffic load. This system can be applied on any type of roads as long as it has traffic light.

LITERATURE REVIEW
With recent advances in wireless technologies, car manufacturers are about to take a quantum leap in terms of enhancing driving safety and comfort by allowing vehicles to communicate with each other and with the roadside infrastructure (Referred to as Vehicular Ad-hoc Networks or VANET). So that, many projects are in progress aiming more safe highways and comfort driving. *For example*; Active Traffic Management (ATM) scheme was developed by the Highway's Agency in Britain to enhance traffic flow and reducing congestion on Motorways in Britain. ATM allows drivers to use the hard shoulder as a normal lane when the traffic is high. And that is an inefficient solution because it would increase the risk of a collision for vehicles stopped. As well as, ATM planning would fail on the roads which do not have hard shoulder.[3]

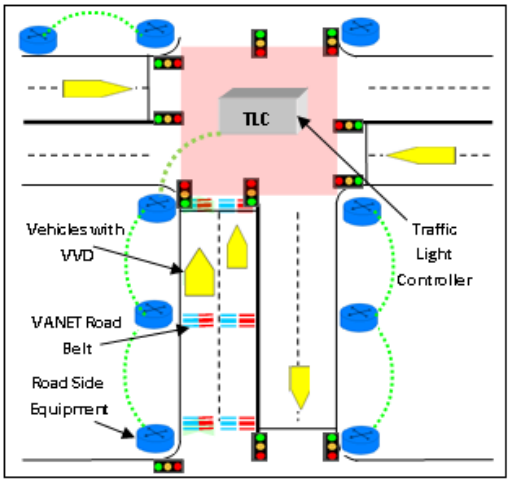


Figure 2. Simplified system setup

In New York, more specifically at the City of Troy, a project was done on summer 2009 to replace the existing antiquated traffic light system with a new one to make the traffic flow more efficient at 22 intersections within the city. One of the project's aims is to reduce the delay in vehicles flow. The project was successful to achieve that goal if it was compared with the antiquated traffic light system. But because the system's management is being taken care of by a central location, then this would lead to non-dynamic mechanism. [25]

Getting back to 1966, [20], two researchers from the corporation of Ohio have invented a traffic remote control system. That system provides the ability for the emergency cars such as police or fire-fighting vehicles to send a signal to the traffic lights asking to change its status from red to green so they reach their emergency destination. This system was serving the emergency vehicles at emergency cases only, while does not ease the traffic flow.

A decade after, exactly on 1979, [8], a researcher has invented an emergency warning system to be placed at the intersections. The principle idea of [8] were based on the same principle ideas in all of [6], [10], [13], [16], and [21]. They all were aiming to create an emergency warning system at intersections but each of them is using different technique to reach that goal.

In the 1980s decade, inventors such as; [2], [12], and [17] kept looking around the emergency vehicle warning system problem, trying to solve it using different techniques to make it more accurate and more efficient. But because of the lack for advanced technology at that time, all the solutions stayed weak in solving that problem in an efficient manner.

METHODOLOGY

The Case-Based methodology has been followed to design our system and the protocol. We have specified a case study then we've designed our architecture and process based on that.

The main case that sparked our methodology is a vehicle stopping at an intersection's traffic light waiting it to get green while the other traffic lights are empty. In other words, the vehicle has waited for some time at the red traffic light when there was no need for it. So we would imagine what would happen if one side is very busy with vehicles at a time when the other sides are idle or semi-idle and the traffic light is changing its phases statically among all the sides.

After doing some surveys, we have found that this problem was partially solved by what is called "actuated traffic Lights". After some more surveys, we have found that there is another technique to ease the flow which's name is "Green Waves".

But there is a major limitation with the Actuated traffic light which is its behavior is like a binary system which would sense vehicles presence only, but It wouldn't tell how many vehicles there are at the traffic light, nor what are the types of the vehicles.

Formal Specification Language For VANET (FSLV)

FSLV consists of sets of symbols and notations which are categorized into six groups. Each group can be used to show or present different aspect; Device Ability (DA), Device Movement (DM), Messages Exchangeability (ME), Device Internal Behavior (IB) logic, Security (Sc), and Design & Configuration (D&C) rules. In [1] we have described each category and its symbols with examples and three case studies as well as both of the consistency and validation tests in details.

System's Participating Devices

Basically, our system has five devices, each of them has its own features and priority to talk first; here we describe each of them:

- *Coordinator Device (Co_D)*: The most capable device. The coordinator forms the root of the network tree in each domain (Road) and might bridge to other domains. There is exactly one coordinator in each network domain since it is the device that started the network originally. It is able to store information about the network domain, including acting as the Trust Centre & repository for security keys. In addition, Co_D can turn on and off the protocols and services. See Figure 3 below.
- *Road Side Equipments (RSE)*: RSE is a device which has the ability of routing, amplifying the coming signals (as a repeater), and supports different types of communication; wired, Dedicated Short Range Communication (DSRC) and WiMAX. In addition, it has database storage to

save the history of the vehicles passed within its coverage. See the Figure4.
Its memory is divided into two main parts; Fixed Memory and Erasable memory. The fixed memory holds the configuration data even when a power failure happens. While the erasable memory holds the instant data which are under processing at a moment of time.

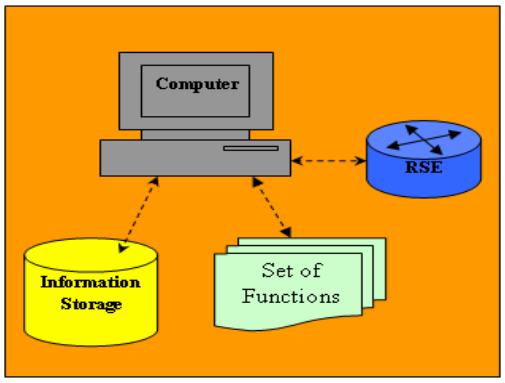


Figure 3. Coordinator Device Architecture

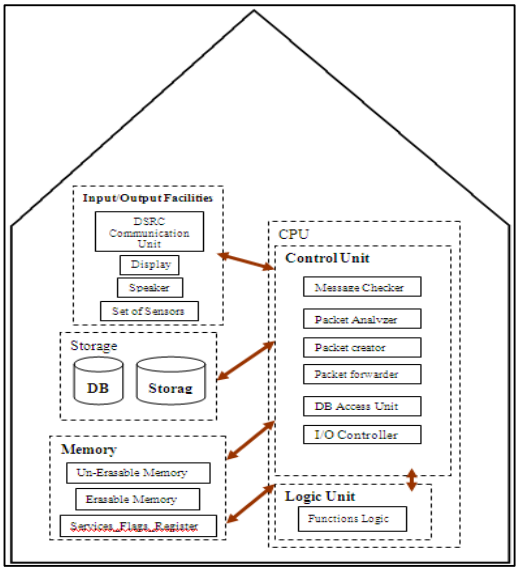


Figure 4. Road Side Equipment internal Architecture

- *Vehicle VANET Device (VVD):* VVD has a mini-Computer which contains the essential components for operating a computer such as I/O devices those can be a touch LCD, speakers, microphone, Communication Facilities to provide DSRC Communication, Processing unit with logic unit which has the RSE's behavior Algorithms, Database system and storage to save the applications, and a memory. See Figure 5.
  Each vehicle would have one VVD that would carry two types of information; fixed information and erasable information. The fixed information would be programmed when manufacturing the vehicle, such as; the vehicle registration number, vehicle model or color…etc., in other words, the data will not be changed when the owner is changed. The erasable information is changeable at specific cases by authorized facilities. As example of the erasable data; the owner name, the speed of the vehicle, ..etc.

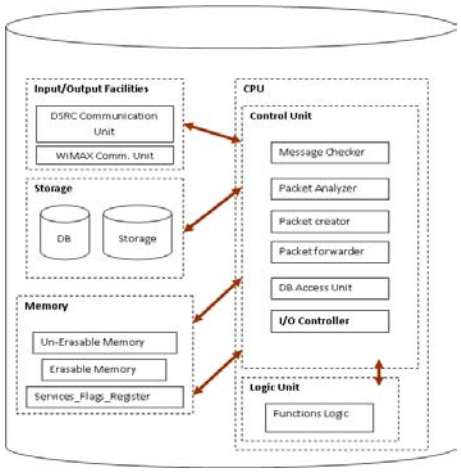


Figure 5. Vehicle's VANET Device Internal Architecture

- *VANET Road-Belt (VRB):* Each entrance and exit way on the road has a belt of sensors placed on the ground to sense the number of vehicles entering and leaving the road. And there is another type of belt placed X of (Kilo) meters before the traffic light which's duty is to count and estimate the load on each lane. See Figure 2.
  The job of the triggers belts is to detect how many tires stepped over it and send a signal to the RSE device which has a set of Trigger Counters. Each lane has up to six sets of triggers; In Figure 6, the road has three lanes, each has two sets, so the number of the triggers Counters installed within the RSE is six counters.

Number of Triggers Counters = No. of Lanes * No. of Trigger Sets of each lane

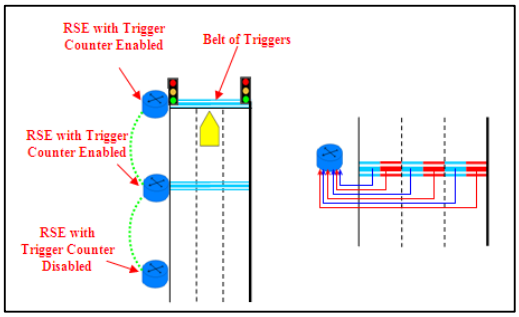


Figure 6. Road's Belts description

- *Traffic Light Controller (TLC):* TLC is positioned at intersections and its main duty is to compare the lanes load values and put a new plan for the traffic

light phases. By looking to the architecture of the TLC in Figure 7 we would see there is a data bus coming as an input to the TLC to deliver the Lanes load values from each side while the traffic lights instant status would be carried by another data bus. So after comparing the load values with considering the history of the traffic lights phase history, a new traffic light phase plan would be decided by the TLC to be implemented on the intersection's traffic lights.

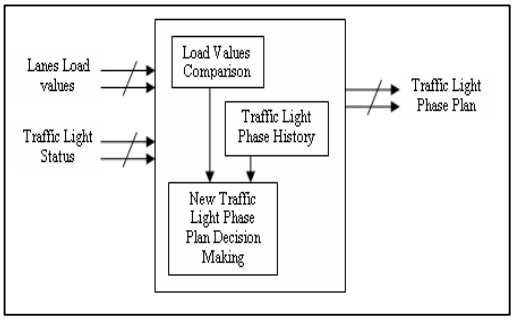


Figure 7. Traffic Light Controller Architecture

Road's Traffic Flow Balance Protocol (RTFBP)

RTFBP is the protocol which is responsible about collecting the information from the road lanes, calculating and comparing the overall loads and creates the dynamic phases plan for the intersection traffic lights. Protocol's stages are:

1. Vehicle Detection (By VRB).
2. Vehicle Registration (By Messaging with RSE).
3. Emergency Case Presence checking (By RSE).
4. Estimating the upcoming load and its approaching time (By RSE with VRB).
5. Getting the Load on the previous traffic light (LTFP).
6. Getting the Load on the next traffic light (LTFN).
7. Calculating the load on each lane of the road.
8. Detecting people aiming to cross the street.
9. Comparing the Load values and making a new phase plan.

RESULTS AND DISCUSSION

The suggested system's architecture has five main devices; Coordinator Device (Co_D), Road Side Equipments (RSE), Traffic-Light Controller (TLC), VANET Road-Belt (VRB), and Vehicle VANET Device (VVD) which can be programmed by authorized people to act as a Police VANET Device (PVD), Fire-Fighting VANET Device (FVD), Ambulance VANET Device (AVD) and Civilian vehicle's VANET Device (CVD).

Based on the suggested architecture a set of algorithms were created to balance the traffic load on roads.

CONCLUSION

The system's hardware architecture was done and was presented, validated and verified mathematically using The Formal Specification Language for VANET (FSLV) which has been created at the beginning for that purpose. The protocol design has been done while currently the formal specification is in process. A simulator is in process of creating using the Java programming language. It is hoped to finish the simulation by the end of the current year so that at least three case studies would be implemented by the early months of 2011.

REFERENCES

[1] M. K. Abbas, 2009, Formal Specification Language for Vehicular Ad-hoc Networks (FSLV), Master's degree thesis, Universiti Teknologi PETRONAS, Malaysia.

[2] G. P Anderson, Emergency Vehicle Traffic Control System, edited by U. S. Patents. USA, 1980.

[3] "M42 Active Traffic Management Scheme, Birmingham, United Kingdom". Road Traffic Technology. SPG Media Limited. "http://www.roadtraffic-technology.com/projects/m42/". Retrieved on December 2009.

[4] O. Brooke, Centralized Traffic Signal Preemption System and Method of Use, edited by U. S. Patents. USA, 2005.

[5] A. P. Davol, Modeling of Traffic Signal Control and Transit Signal Priority Strategies in a Microscopic Simulation Laboratory, Department of Civil and Environmental Engineering, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, 2001.

[6] E. T. Coll, H. J. Braschwitz, C. Grace, M. J. Manchester, and S. A. Hunter. Emergency Vehicle Control of Traffic Signals, edited by U. S. Patents. USA, 1972.

[7] M. Cops, Program Manager, Vehicle Infrastructure Integration Consortium, VII Strategy for Safety and Mobility Program, Sept 29 2006.

[8] E. Elmasian, Traffic Light Radio Control System, edited by U. S. Patents. USA.

[9] Gedawy, Hend Kamal. 2008. Dynamic Path Planning and Traffic Light Coordination for Emergency Vehicle Routing, 1979.

[10] E. Harsanyl, Traffic Signal, edited by U. S. Patents. USA, 1972.

[11] Highways. *Active Traffic Management (ATM)*:http://www.highways.gov.uk/news/1334.aspx 2006 [cited Dec. 16, 2009].

[12] F. N. King, Detection System for Emergency Vehicles With Signal Preemption Means, edited by U. S. Patents. USA, 1982.

[13] W. R. Koch, Radio Traffic Control, edited by U. S. Patents. USA, 1940.

[14] S. Koenig, and M. Likhachev, Improved Fast Weplanning for Robot Navigation in Unknown Terrain. Paper read at IEEE International Conference on Robotics & Automation, at Washington, DC, 2002.

[15] E. Kwon, and S. Kim. Development of Dynamic Route Clearance Strategies for Emergency Vehicle Operations, Phase I: Minnesota Department of Transportation, 2003.
[16] W. H. Long, Traffic Signal Remote Control System, edited by U. S. Patents. USA, 1970.
[17] W. L. Mitchell, Traffic Light Control for Emergency Vehicles, edited by U. S. Patents. USA, 1984.
[18] R. K. Morgan, Traffic Signal Preemption System, edited by U. S. Patents. USA, 1990.
[19] Book "Vehicular Networks: From Theory to Practice", "NOTICE – An Architecture for Traffic incident Detection", Stephan Olariu, Michele C. Weigle, 2009.
[20] P. C. Campana, and T. T. Chrysler. Emergency Traffic Control System, edited by U. S. Patents. USA, 1966.
[21] P. J. Pichey, Intersection Emergency Warning System, edited by U. S. Patents. USA, 1977.
[22] M. T. Robertson, Traffic Light Control Means for Emergency-Type Vehicles. USA, 1994.
[23] L. L. Rose, Emergency Traffic Control System With Security transmission coding, edited by U. s. Patents. USA, 1977.
[24] C. Schroth; Strassberger, Markus ; Eigner, Robert ; Eichler, Stephan: A Framework for Network Utility Maximization in VANETs. In: Proceedings of the 3rd ACM International Workshop on Vehicular Ad Hoc Networks (VANET) : ACM SIGMOBILE, 2006.- 3rd ACM International Workshop on Vehicular Ad Hoc Networks (VANET).- Los Angeles, USA, p.2
[25] Traffic Signals Improvement Project, http://www.troyny.gov/projects/trafficsignalimprovement.html, Retrieved on 11 – Dec – 2009.

A Study on Using Sea Mango's Oil for Lipase Production by *Pseudomonas aeruginosa*

Mohd Zulhilmi Wan Salleh[1,*], Murthy Veluri V. P. S.[2]
[1, 2] Faculty of Chemical Engineering, Universiti Teknologi Mara (UiTM), 40000 Shah Alam, Selangor,Malaysia
*email: myzulhilmi@yahoo.com

Abstract
This paper investigated the using of Sea Mango's oil which act as inducer and also as enhancement for lipase production by Pseudomonas aeruginosa (ATCC 27853).The first part in this study was extraction of the oil from this sea mango's seed whereas the second part focused on using sea mango's oil for the lipase production by fermentation process. There are several parameters were emphasized in order to optimum the usage of sea mango's oil as inducer which are time of incubation, pH of medium condition and concentration of sea mango's oil. It was found that the seed gave the promising results to contain high percentage of oil up to 53% and the concentration of 3% of this oil with pH medium approximate to pH7 and also the period of late log phase of growth microbes was found to be the best condition for the optimization of using this sea mango's oil for enhance lipase production.

Keywords
Sea mango's oil, fermentation, lipase, inducer

INTRODUCTION

Cerbera odollam Gaertner (pink-eyed cerbera, yellow eyed cerbera, odollam tree), also sometimes called *Cerbera manghas L*, belongs to the notoriously poisonous Apocynaceae family, which also includes the yellow oleanders (Thevetia peruviana and Thevetia nerifolia) and common oleanders (Nerium oleander and Nerium indicum). The *Cerbera odollam* tree grows to a height of 6–15m and has dark green fleshy lanceolate leaves. The large white flowers have a delicate perfume, reminiscent of jasmine. The seeds contain non-siccative oil, producing a shining flame with a pleasant nut-like odour. Seeds are extremely poisonous. The Burmese use it for lighting, as a cosmetic, or mixed with other oils as an insecticide or insect-repellent (Chopra et al., 1956).

Also known as sea mango to the local, it is common to be found along the seashore throughout the Philippines. It is also reported from the tropical Asia through Malaya to tropical Australia and Polynesia. In Peninsular Malaysia, the oil from the seeds of *Cerbera venenifera* is rubbed on the skin as a rubefacient and as a cure for itching, or applied to the hair as an insecticide (Gaillard et al., 2004, Minh Hiˆen et al., 1991).

Enzymatic reactions using lipase enzyme are used to produce value-added products from oils. Lipases (triacylglycerol hydrolases, EC 3.1.1.3) are produced and secreted into the culture medium by a large variety of microorganisms, namely fungi and bacteria.

It has been found that, there is no antimicrobial activity observed for Escherichia coli and *Pseudomonas aeruginosa* using *Cerbera odollam* as biomass component. (M.H. M. Amini et al., 2008). It means that the *Pseudomonas aeruginosa* can grow with the sea mango as base media. This could be because both are Gram negative bacteria that are more resistant to antimicrobial agent than the Gram positive bacteria. One of the several unique characteristics of Gram-negative bacteria is the outer membrane of the cell that is responsible for protecting the bacteria from destruction of the inner membrane or cell wall (peptidoglican). (M.H. M. Amini et al., 2008)

Supplementation of growth media with other carbon sources was used to enhance the production of lipase enzyme. Lipase showed good activity when carbon source substrates were altered i.e. Tween 20, coconut oil, olive oil it can be safely assumed that the enzyme had a broad range of specificity. (Pratyoosh Shukla and Kshitiz Gupta, 2007).

Previous study proofs that, *Pseudomonas aeruginosa* which is very useful microbes to produce lipase can grow in the media contain sea mango as a base growth media. As we know, this lipase is very important in our industry especially in the dairy industry, detergents industry, oleochemical industry, pharmaceutical industry, cosmetic industry and medical applications. Study also shows that, plant oil such as castor oil, soybean oil, palm oil can act as an inducer for lipase production. In addition, because there are no producers of this enzyme in this country have come to this the great idea of this research to produce lipase using sea mango oil by *Pseudomonas aeruginosa*.

MATERIAL AND METHOD

Material

The fruit of Sea Mango were collected from Pendang, Kedah which are abundant in area of school as shade plant and also around area paddy field which locally used as rat repellant. n-Hexane (minimum purity of

96%) was purchased from MERCK. While for fermentation setup the chemical and media used for growth and other chemicals were obtained from commercial sources and were of the highest qualities available.

Extraction of oil

The seed of sea mango fruit were dried overnight in the oven with temperature of 55°C to remove excess moisturize. As describe by J.Kansedo (2009) and his friends the dried seeds were then weighed and grinded into fine particles of 0.5–10 mm in size. Then, the extraction of oil using soxhlet extractor was fixed to 6 hour for each batch. Whereas the solvent used was n-hexane with the ratio 1:5 of weight of grinded sea mango seed and n-hexane respectively. The oil was recovered from solvent using rotary evaporator. The extracted oil was stored for fermentation process.

Microorganism and medium

Pseudomonas aeruginosa (ATCC 27853) was reserved in Faculty of Pharmacy Universiti Teknologi Mara Shah Alam, Selangor, Malaysia. The strain was inoculated on Pseudomonas Isolation Agar Base (Sisco) grown at 37°C for 24 hours and stored at 4°C.

Lipase fermentation

Inoculum was prepared before fermentation was carried out. One loop of cell growth on agar plate was inoculated in 20ml nutrient broth medium and incubated at 37°C on a rotary shaker at 200rpm for overnight culture was an about 16 hours. Then, the 20ml of this precultured fluid was growth in 1L conical flask containing 400 ml of the medium. The medium composed of 1%(v/v) of oil, 1g/L K_2HPO_4, 1g/L $NaNO_3$, 0.5g/L $MgSO_4.7H_2O$ and 3g of yeast with an initial pH of 6.5 for the base studies. The sample was taken out with periodically at each of 12 hours for lipase activity analysis.

Lipase preparation

The samples which were taken out were measured the turbidity of cell growth at wavelength of 600nm. Then it was centrifuged at 12000 rpm for 20 minutes. The supernatant was used as the crude enzyme for the estimation of lipase activity.

Determination of enzyme activity

Lipase activity was determined by a spectrophotometric(SECOMAM) method by using p-nitrophenil-laurate (pNPL) as substrate. The assay consists of 0.10 mL enzyme extract (supernatant), 0.80 mL 0.05M phosphate buffer (pH 6.5), and 0.10 mL 0.01M pNPL in ethanol. The hydrolytic reaction was carried out at 60oC for 30 minutes, and then 0.25 mL of 0.1M Na_2CO_3 was added. The mixture was centrifuged at 14000 rpm for 10min at 25oC. The absorbance at 410nm was determined. One unit of lipase activity was defined as the amount of enzyme that caused the release of 1µmol of p-nitrophenol from pNP-laurate in 30 minutes under test conditions.

Results and discussion

Sea mango's oil was successfully extracted following method by J.Kansedo et al (2009). The oil extracted from sea mango's seeds was 53% (w/w). Generally this technique required soxhlet extractor using n-hexane as solvent and also rotary evaporator to recover the oil.

Lipase production by *Pseudomonas aeruginosa* was carried out in a 1L conical flask with working volume of 400ml media. One loop of the overnight culture of *Pseudomonas aeruginosa* growth on agar plate was used as inocolum starter in a fermentation flask. The sea mango's oil act as a carbon sources and also substrate to enhance the production of lipase. The production of lipase from *Pseudomonas aeruginosa* was carried out at different time intervals, varied medium pH and also at substrate concentration.

The *Pseudomonas aeruginosa* was cultured in minimal medium, the growth for negative control which was without sea mango's oil are plot in the graph as shown in figure 1. As stated by R.Gaur et al (2008) the lipase activity was reached to maximum in late log phase. From the graph the late log phase of negative control for medium without inducer of sea mango's oil was achieved at maximum of lipase activity at hour of 48.

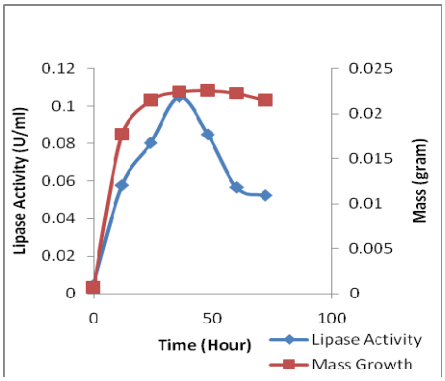


Figure 1: Growth of *Pseudomonas aeruginosa* without sea mango's oil

Effect of incubation time

Lipid carbon sources seem to be essential for obtaining high lipase yield due to their potential inducing ability. As Elibol and Ozer (2000a) reported, in the presence of corn oil, lipase activity was approximate 2.5 times higher than in the absence of inducer. Figure 2 shows that the lipase activity was higher in the medium present of sea mango's oil compare to medium without oil which was glucose as only a carbon sources for the negative control. The maximum lipase activity achieved at 48 hours was 0.09U/ml for medium with oil while for the negative control medium was 0.02U/ml. The incubation time at hour of 72 shows high lipase production, even though at that time, the growth of cell was at death phase. This was because the

during the death phase, the cell having autolysis its cell wall as a result of the higher lipase obtained.

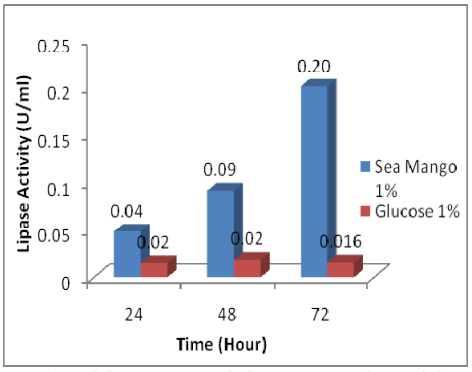


Figure 2: Lipase activity growth with sea mango's oil compare to negative control without oil.

Effect of pH medium

The results on the effect of medium pH on the 1 % (v/v) of sea mango's oil indicated that the lipase production were maximum (0.09 U/ml) at pH 7. In low (5) and also at high (9 and 11) medium pH, the lipase activity was less as described in figure 3. These experiments were carried out in the conical flask, so only the initial of the pH can be adjusted to keep its sterilized condition.

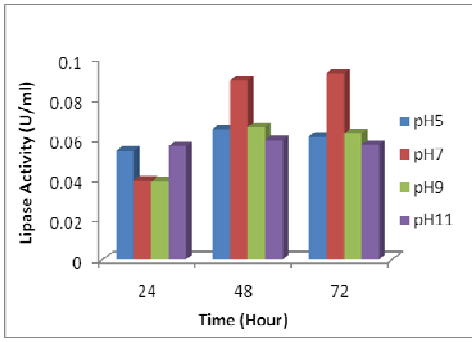


Figure 3. Effect on the production of lipase on different pH medium for 1% (v/v) of the sea mango's oil.

Effect of substrate concentration

The effect of the concentration of the carbon source on lipase production was studied with the addition of different concentrations (0.1, 0.5, 1, 3, and 5 %) (v/v) of sea mango's oil. Figure 4 summarized the lipase activity with the different concentration of sea mango's oil which was used as carbon sources for *Pseudomonas aeruginosa*. The highest lipase activity was achieved with the concentration of 3% of sea mango's oil. This result was agreed with Sarkar et al., (1998) showed that olive oil at a concentration of 7% (v/v) resulted in an increase in lipase production by *Pseudomonas sp*, but at the higher concentration, the lipase activity ceased drastically. Same goes to sea mango's oil at 5% concentration, the lipase activity show less activity. In same conditions, the inhibition of lipase synthesis at higher olive oil concentration could be due to poorer oxygen transfer into medium which can alter fungal metabolism and consequently the production of lipase enzyme itself (Elibol & Ozer, 2000b).

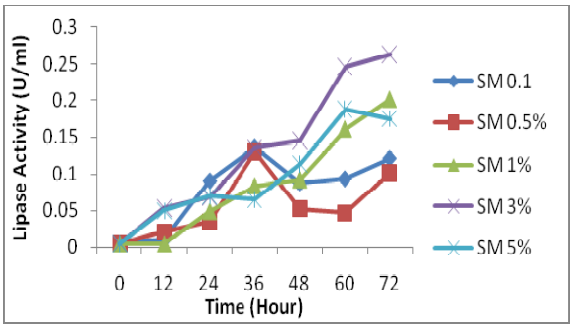


Figure 4: Effect on the production of lipase on different of substrate concentration of the sea mango's oil

Conclusion

The sea mango fruit can be a potential alternative feedstock for non edible oil production. The used of sea mango's oil as a carbon sources for lipase production was successfully achieved compared to production without sea mango's oil as inducer. This is ongoing research which the study of this oil as an inducer in lipase production media will be carried out with other parameters soon.

Acknowledgement

The authors would like to thank Universiti Teknologi Mara (UiTM),Shah Alam for providing lab facilities and also Ministry of Science,Technology & Innovation (MOSTI) for grant the E-science Fund for this project.

REFERENCES

[1] Chopra, R.N., Nayar, S.L., Chopra, I.C.,Glossary of Indian Medicinal Plants, CSIR, New Delhi.(1956)

[2] Gaillard Y, Krishnamoorthy A, Bevalot F, *Cerbera Odollam*: A 'Suicide Tree' and Cause of Death in the State of Kerala, India. J Ethnopharmcol, 95 (2004) 123–6.

[3] M.H. M. Amini, R. Hashim, O. Sulaiman1, S. F. Sulaiman, F. Kawamura, and R. Wahab, Investigation on Antimicrobial Activity of Biomass Components of *Cerbera Odollam*. International Conference on Environmental Research and Technology (ICERT 2008), Biodiversity Conservation & Protected Areas Management, (2008) 459-462

[4] Pratyoosh Shukla and Kshitiz Gupta, Ecological Screening for Lipolytic Molds and Process Optimization for Lipase Production from Rhizopus Oryzae KG-5. Journal of Applied Sciences in Environmental Sanitation, (2007) 35-42.

[5] Jibrail Kansedo, Keat Teong Lee, Subhash Bhatia, Cerbera Odollam (Sea Mango) Oil as A Promising

Non-Edible Feedstock for Biodiesel Production, Fuel, 88 (2009) 1148–1150

[6] Gaur Ruchi, Gupta Anshu, S.K. Khare, Lipase from Solvent Tolerant *Pseudomonas Aeruginosa* Strain: Production Optimization by Response Surface Methodology and Application Bioresource Technology, 99 (2008) 4796–4802

[7] M. Elibol, D. Ozer, Process Biochem, 36 (2000a) 219–223

[8] Sarkar S, Sreehanth B,Kant S, Banerjee R & Bhattacharyya BC, Production and Optimization of Microbial Lipase. Bioprocess Engineering, 19(1998) 29-32.

[9] M.Elibol & D.Ozer, Influence Of Oxygen Transfer on Lipase Production by Rhizopus Arrhizus, Process Biochemistry, 36 (2000b) 325-329.

Exploring Potential Markets for Nuclear Power Plant Training Based on Human Development Index (HDI)

Yeoh Chien Wern
College of Graduate Studies (COGS)
Universiti Tenaga Nasional (UNITEN)
Jalan IKRAM-UNITEN, 43000 Kajang, Selangor, Malaysia
Email: yeohcw@tnb.com.my

Abstract

Nuclear power has always been a taboo topic for Malaysia, but the recent announcement of the construction of nation's first nuclear power plant has brought a paradigm shift to country's traditional mindset. The implementation of nuclear power is almost inevitable due to the volatility of fossil fuel cost and forecasted country's natural gas depletion in year 2019 [1]. Such potential major changes in Malaysia's generation mix will result in much overhaul in local power industries especially to training and education business. Hence, TNB Integrated Learning Solution Sdn Bhd (ILSAS), being the sole training subsidiary of TNB, has an important role to play for human capital development in nuclear related training. Apart from the internal preparation in facing nuclear power plant training, it is also crucial to explore the potential market for training business, which serves as the main objective of this research paper. This paper will discover the potential market for ILSAS using quantitative research approach as secondary data of world countries Human Development Index (HDI) will be gathered and examined using semi-data mining methodology. Pattern of past nuclear countries' first connection to grid will be analyze to obtain the average HDI for nuclear emergence, which later be used as the technical threshold for future prediction.

The Activation of Seed Sludge and Start-up Phase of POME Treatment Using HUASB Reactor

S. A. Habeeb [1,*], Ab. Aziz Abdul Latiff [1,*], Zawawi Daud [1], Zulkifli Ahmad [1]
[1] Faculty of Civil and Environmental Engineering, University Tun Hussein Onn Malaysia (UTHM).
* sinan_env@yahoo.com, aziz@uthm.edu.my

Abstract
Several categories of anaerobic wastewater treatment have been implemented in order to treat the palm oil mill effluent POME. In this study the hybrid up-flow anaerobic sludge blanket HUASB was employed in a start-up period of 57 days, whereby three reactors R1, R2, and R3 were operated in order to provide two separated comparisons. Identical operation conditions of OLR and HRT of 1.85kg.m^{-3}.day^{-1}, and 2.6 day respectively in each reactor. R1 was operated in room temperature of 28±2°C, and packed with palm oil shell as filter media. R2 was set with room temperature but packed with course gravel as supporting medium. R3 was provided with water bath system to adjust its temperature at 37±1°C mesophilic, while its filter material had to be palm oil shell. During the whole operation period R3 was higher efficient for organic materials, where a COD removal efficiency of 82% was registered, while R1 and R2 were less efficient of 77%, and 76% respectively. Furthermore, TSS removal of R3 was also higher than R1, and R2 as registered 80%, 77% and 76% respectively. On the other hand, turbidity and colour investigations were not efficient and needed a post treatment. The seeded sludge was developed in each reactor as illustrated in this paper. This paper presents the initial development of microorganisms communities inside the entire reactors. Nonetheless, a comparison of the mentioned aspects was investigated.

Keywords
Anaerobic treatment, POME, HUASB, sludge bacterial, nutrients.

Molecular Phylogeny of Horseshoe Crab Using Mitochondrial Cox1 Gene as a Benchmark Sequence

*B. Akbar John[1], K.C.A. Jalal[1], Y.B. Kamaruzzaman[1], K. Zaleha[2], K. Prasanna[3]
dhaka89@hotmail.com, kama@iiu.edu.my, zaleha@umt.edu.my
[1]International Islamic University Malaysia, Jalan Sultan Ahmad Shah, Bandar Indera Mahkota, 25200 Kuantan, Pahang, Malaysia
[2]Institute of Aquatrop, Universiti Malaysia Terengganu, 21030 Kuala Terengganu, Terengganu, Malaysia
[3]Center of Advanced Study in Marine Biology, Annamalai University, Parangipettai, India
Corresponding Author: akbarjohn50@gmail.com

Abstract
An effort to assess the utility of 650 bp Cytochrome C oxidase subunit I (DNA barcode) gene in delineating the members horseshoe crabs (Family: xiphosura) with closely related sister taxa was made. A total of 33 sequences were extracted from National Center for Biotechnological Information (NCBI) which include horseshoe crabs, beetles, common crabs and scorpion sequences. Constructed phylogram showed beetles are closely related with horseshoe crabs than common crabs. Scorpion spp were distantly related to xiphosurans. Phylogram and observed genetic distance (GD) date were also revealed that Limulus polyphemus was closely related with Tachypleus tridentatus than with T.gigas. Carcinoscorpius rotundicauda was distantly related with L.polyphemus. The observed mean Genetic Distance (GD) value was higher in 3rd codon position in all the selected group of organisms. Among the horseshoe crabs high GC content was observed in L.polyphemus (38.32%) and lowest was observed in T.tridentatus (32.35%). We conclude that COI sequencing (barcoding) could be used in identifying and delineating evolutionary relatedness with closely related species.

KEYWORDS
Cytochrome C oxidase subunit I; DNA barcoding; Codon position; Horseshoe crabs.

INTRODUCTION
Mitochondrial DNA (mtDNA) analysis has been employed in the evolutionary study of the animal species for more than 30 years [1,2]. Its higher mutational rate and lower effective population size than the nuclear DNA make mtDNA a powerful tool to probe for evolutionary studies. This fact provoked a proposal to standardize DNA-based species identification by analyzing a uniform segment of the mitochondrial genome. A library of sequences from taxonomically verified voucher specimens could be built with this approach which could serve as DNA identifiers for species, in short, DNA barcodes [3]. For animals, 648-bp segment of the mitochondrial gene cytochrome C oxidase I (COI), which can be readily recovered from diverse species with a limited set of primers, was declared as a DNA barcode [4]. For this DNA barcoding approach to be effective, it must be possible to distinguish between intraspecific and interspecific mtDNA variation. The simplest test is whether the genetic distance within the species is lesser than those between species.

There are four extant species of horseshoe crabs, *Tachypleus tridentatus, Tachypleus gigas, Carcinoscorpius rotundicauda,* and *Limulus polyphemus* [5]. The first three species inhabit the Southeast Asian coast and the last species the east coast of North America. For elucidating their phylogenetic relationships, two proteins, coagulogen and hemocyanin, have been investigated [6-8]. It was first investigated tropomyosin which is one of the major structural proteins involved in many types of cells, to elucidate prevailing phylogenetic relationships among horseshoe crabs and his result suggested that *L. polyphemus* is phylogenetically differentiated far from the three Asian species [9]. But the results were not those which were worth studying from the detailed phylogenetic viewpoint, that is, the patterns of the four species were equally different from each other. When the proteins were cleaved with chymotrypsin or trypsin, only smaller differences than those obtained with V8 protease were found [9].

As, COI has been proposed as a barcode gene for most of the eukaryotes [3]. To enhance our understanding on the phylogeny of horseshoe crab, in the present study the COI diversity within and among genetically related groups of organisms with horseshoe crabs sequences were analyzed to find out phylogenetic signals in barcode region as well as to find out evolutionary relationship of available 4 species of horseshoe crabs.

MATERIALS AND METHODS

Sequence features
A total of 33 barcode sequences belong to horseshoe crab (12) insects including beetle (8) common crab (5) and scorpion (8) were extracted from National Center for Biotechnological Information (NCBI) via FASTA format. Pair wise sequence alignment of nucleotide sequences were performed using ClustalX

2.0.6 [10]. The GC content of all 33 barcodes was estimated by BioEdit sequence alignment editor [11]. MEGA 4.1 Beta3 [12] was used to construct phylogenetic trees via Neighborhood joining method using Kimura 2-parameter and to calculate genetic distance of the given set of sequences in each codon position. Details of sequences used to generate the phylogram are given in Table 1.

Organism	Accession ID	Sequence length (bp)	GC content %
Limulus polyphemus	EU834780	1677	37.69
Limulus polyphemus	AF218278	552	36.96
Limulus polyphemus	U09392	582	38.32
Limulus polyphemus	U09391	582	38.32
Limulus polyphemus	NC_003057	1536	37.89
Limulus polyphemus	AF216203	1536	37.89
Tachypleus tridentatus	FJ860267	1536	33.07
Tachypleus tridentatus	EF460846	473	32.35
Tachypleus tridentatus	U09387	582	32.65
Tachypleus gigas	U09388	582	33.85
Carcinoscorpius rotundicauda	U09389	582	35.74
Carcinoscorpius rotundicauda	U09390	582	35.91
Centruroides limpidus	NC_006896	1533	39.40
Centruroides limpidus	AY803353	1533	39.40
Centruroides nigrimanus	AY995838	1530	38.43
Centruroides elegans	AY995824	1530	38.76
Centruroides sculpturatus	AY995831	1530	37.25
Centruroides noxius	AY995829	1530	38.24
Centruroides baergi	AY995823	1515	38.81
Centruroides vittatus	AY995835	1530	37.91
Scylla serrata	GU055514	535	32.71
Scylla serrata	GU055513	535	32.71
Portunus pelagicus	AF082732	465	34.41
Portunus pelagicus	FJ812293	1186	37.10
Portunus reticulatus	EF661975	573	35.78
Drosophila quadrisetata	DQ471563	1500	29.60
Drosophila angor	DQ471568	1500	31.93
Drosophila beppui	DQ471581	1500	28.87
Drosophila roehrae	EF570015	1443	31.95
Drosophila beppui	DQ471557	1500	28.87
Paramblopusa borealis	FJ749943	907	29.44
Paramblopusa eoa	FJ749944	907	29.77
Sternhydrus atratus	DQ813703	1265	29.57

Table 1: Total number of organisms used to construct the phylogram and their respective accession ID with total sequence length (bp) is given. Percentage of GC content for each organism was calculated using Bioedit sequence alignment editor V.7.0.9.0 [11].

RESULTS AND DISCUSSION

Phylogenetic analysis

A phylogenetic tree was constructed to verify the efficiency of coxI gene in delineating closely related species of horseshoe crab and to check its evolutionary relationship with other groups of organisms which are proved to be closest relatives of xiphosurans. The constructed phylogram showed two distinct Clads (A and B). Almost all the internal branches showed high bootstrap value (> 90). Clad A includes horseshoe crabs, beetles and common crab species and all the scorpion species were distinctly clustered in clad B. This clearly indicated that horseshoe crabs are distantly related with scorpions at DNA level. Among the horseshoe crabs L. polyphemus showed distant genetic relatedness with other 3 species of horseshoe crab. This result was also well corresponded with previous finding by wherein the phylogram clearly demarcated phylogeny of horseshoe crab and hence *L. polyphemus* is differentiated far from the three other species [13]. *T. gigas* showed closer genetic relationship with *C.rotundicauda* than with *T.tridentatus* which is a false alignment probably due to the number of sequence of *T.gigas* used in constructing phylogram was not sufficient. As it was expected insects (beetles) used in this study was perfectly arranged in clad A showing higher genetic similarity (lesser genetic distance) with horseshoe crab and common

crabs were showing higher genetic distance with xiphosurans indicating that evolution of horseshoe crab might probably from ancient aquatic insects. Eurypterids have traditionally been regarded as close relatives of Horseshoe Crabs; together forming a group called Merostomata.

Subsequent studies placed eurypterids closer to the arachnids in a group called Metastomata [14]. There has also been a prevailing idea that eurypterids are closely related to terrestrial scorpions [15].The most recent study of relationships between arachnids and their relatives recognized Eurypterida, Xiphosura and Arachnida as three major groups, but was not able to resolve details between them [16]. Same result was reflected in the present study by separating scorpion species in a clad B indicating that horseshoe crabs have lesser genetic relatedness with terrestrial scorpions (Figure 1).

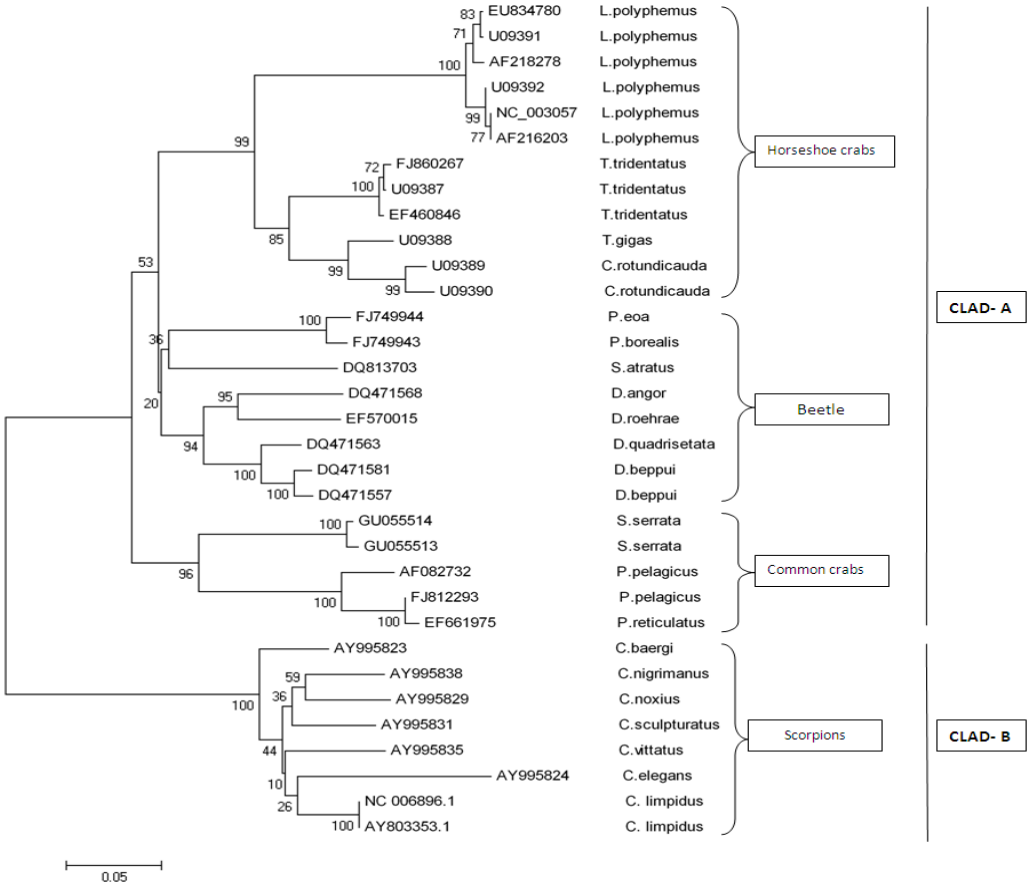


Figure 1: The evolutionary history was inferred using the Neighbor-Joining method [17]. The optimal tree with the sum of branch length = 1.67404499 is shown in figure. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (500 replicates) is shown next to the branches [18]. The tree is drawn to scale, with branch lengths in the same units as those of the evolutionary distances used to infer the phylogenetic tree. The evolutionary distances were computed using the Kimura 2-parameter method and are in the units of the number of base substitutions per site [19]. Codon positions included were 1st+2nd+3rd+Noncoding. All positions containing gaps and missing data were eliminated from the dataset (Complete deletion option). There were a total of 434 positions in the final dataset. Phylogenetic analyses were conducted in MEGA4 [12].

Another interesting observation made from the genetic distance calculation was higher genetic distance in third codon position than its corresponding first and second codon positions. Similar observation was made while barcoding of fishes from Australian waters [20]. It was also observed that greater phylogenetic signal is often found in parsimony-based analyses of third codon positions of protein-coding genes relative to their corresponding first and second codon positions, even for early-derived basal clades [21]. Mean genetic distance within *L.polyphemus* at 1st, 2nd and 3rd codon position were 0.01, 0.009 and 0.025 respectively. Likewise for *T.tridentatus* it was 0.014, 0, and 0.005

at 1st, 2nd and 3rd codon position respectively. In case of *C.rotundicauda* the mean genetic distance values were 0.014, 0.014 and 0.05 at 1st, 2nd and 3rd codon position respectively (Table 2).

		L.polyphemus				*T.gigas*				*T.tridentatus*				*C.rotundicauda*			
	codon Position	1st+2nd+3rd	1st	2nd	3rd	1st+2nd+3rd	1st	2nd	3rd	1st+2nd+3rd	1st	2nd	3rd	1st+2nd+3rd	1st	2nd	3rd
L.polyphemus	1st+2nd +3rd	0.015				0.193				0.201				0.195			
	1st		0.01				0.143				0.153				0.125		
	2nd			0.009				0.065				0.05				0.047	
	3rd				0.025				0.419				0.462				0.493
T.gigas	1st+2nd +3rd					0				0.111				0.067			
	1st						0				0.084				0.043		
	2nd							0				0.028				0.021	
	3rd								0				0.242				0.144
T.tridentatus	1st+2nd +3rd									0.006				0.12			
	1st										0.014				0.098		
	2nd											0				0.014	
	3rd												0.005				0.281
C.rotundicauda	1st+2nd +3rd													0.260			
	1st														0.014		
	2nd															0.014	
	3rd																0.05

Table 2: Average genetic distance (GD) between four available species of horseshoe crabs observed in different codon positions

Average genetic distance among the different groups of test organisms showed higher GD value at 3rd codon position indicating that detailed study on 3rd codon position might reveal possible evolutionary information among the closely related groups of organisms. Mean GD value within horseshoe crab was 0.095, 0.033 and 0.301 at 1st, 2nd and 3rd codon position respectively. The GD value between Insects (beetle) and horseshoe crabs were 0.201, 0.094 and 0.468 at 1st, 2nd and 3rd codon position respectively proved that horseshoe crabs are genetically more related with insects followed by common crabs (GD values: 1st = 0.256; 2nd = 0.108 and 3rd = 0.527). Terrestrial scorpion species were showing higher mean GD value with horseshoe crabs (1st = 0.445; 2nd = 0.174 and 3rd = 1.016) clearly demarcated their distant genetic relatedness (Table 3).

	1st+2nd+3rd Codon Position	Ist Codon Position	2nd Codon Position	3rd Codon Position
	Horseshoe crabs	Horseshoe crabs	Horseshoe crabs	Horseshoe crabs
Horseshoe crabs	0.13	0.095	0.033	0.301
Insect (Beetles)	0.239	0.212	0.094	0.468
Crabs	0.275	0.256	0.108	0.527
Scorpions	0.45	0.445	0.174	1.016

Table 3: Mean genetic distance (GD) values of different groups of organisms with reference to horseshoe crab at all the possible codon position indicating 3rd codon position shows higher GD value.

CONCLUSION

The COI sequence in the phylogram constructed clearly clustered the selected species in individual group, proving the efficacy of COI gene in delineating the members of evolutionarily cryptic groups of organisms. Constructed phylogram and genetic distance data clearly proved that horseshoe crabs are more genetically related to insects (Class: Insecta) than with common crabs and are distantly related with terrestrial scorpions. But further studies need to be conducted to prove this concept by analyzing total mitochondrial DNA sequence. We could also conclude that the greater phylogenetic signal is often found in third codon position relative to their corresponding first and second codon positions as reported earlier [20, 21].

ACKNOWLEDGEMENT

Authors wish to express their sincere gratitude to International Islamic University Malaysia (IIUM) and Institute of Oceanography and Maritime Study (INOCEM) for providing infrastructural facilities.

REFERENCES

[1] Brown, W. G., George, M., & Wilson, A. C. Proc. National Acad. Sci. USA, 76: 1967-1971. (1979).
[2] Avise, J. C., & Walker, D. Proc. National Acad. Sci. USA, 96: 992-995. (1999).
[3] Herbert, P. D. N., Cywinska, A., Ball, S. L., & Dewaard, J. R., Proc. Royal Soc. Lon. Series B, Bio Sci, 270: 313-321. (2003)
[4] Kevin, C., Kerr, R., Stoeckle, M. Y., Dove, C. J., Weigh, L. A., Francis, C. M., & Hebert, P. D. N., Mol. Ecol. Not. 3: 2229-2237. (2007)
[5] Pocock, R. I., *Ann. Mag. nat. His. Set.* 7, 256-266. (1902)
[6] Shishikura, F., Nakamura, S., Takahashi, K., & Sekiguchi, K. *C. J. exp. Zool.* 223, 89-91. (1982)
[7] Srimal, S., Miyata, T., Kawabata, S., Miyata, T., & Iwanaga, S. *J. Biochem. (Tokyo) 98,* 305-318. (1985)
[8] Sugita, H., In *Invertebrate Oxygen Carriers* (Edited by Linzen B.), pp. 293-296.Springer, Berlin. (1986)
[9] Jun-Ichi Miyazaki, Tadashi Ishimoda-Takagi, Koichi Sekiguchi, & Tamio Hirabayashi. *Comp. Biochem. Physiol.* 93B, (3): 681-687, (1989).
[10] Thomson, J. M.. Mem Qld Mus 41:457–562. (1997)
[11] Hall, T. A., Nucl. Acids. Symp. Ser. 41:95-98. (1999).
[12] Tamura, K., Dudley, J., Nei, M., & Kumar, S. Mol. Biol. Evol. 24:1596-1599. (2007)
[13] Miyazaki J-I., Sekiguchi, K., & Hirabayashi T. *Biol. Bull.* 172, 212-224. (1987)
[14] WEYGOLDT, P. & PAULUS, H. F. *Zeitschrift fur zoologische Systematik- und Evolutionsforschung*, 17: 85–116, 177–200. (1979).
[15] VERSLUYS, J., & DEMOLL, R. *Koninklijke Akademie van Wetenschappen Amsterdam*, 23: 739–765. (1920).
[16] SHULTZ, J. W. . *Zoo. J. Linnean Soc.*, 150:221–265. (2007)
[17] Saitou, N., & Nei, M., Mol. Biol. Evol. 4:406-425. (1987)
[18] Felsenstein, J., Evolution 39:783-791. (1985)
[19] Kimura, M., J. Mol. Evol. 16:111-120. (1980).
[20] Ward, R. D., Zemlak, T. S., Innes, B. H., Last, P. R., & Hebert, P. D. N. Philo. Transsac. *Royal Soc. Lon. Biol. sci.* 360, 1847–1857. (2005).
[21] Simmons, M. P., Zhang, L. B., Webb, C. T., & Reeves, A. plants Sys. Biolo. 55, 245-258 (2006)

Carbon Dioxide Removal by using Alkanolamines

Noorhaliza Aziz
University of Malaya, Kuala Lumpur, Malaysia
liza_aziz77@siswa.um.edu.my

System Behavioral Success Model (SBS): Assessment of IS Success from the Organizational Perspective

Zakariya Belkhamza [1,*]
[1]School of Business and Economics, Universiti Malaysia Sabah
*zakariya@ustc.edu

Abstract
The question of why particular IS encountered unanticipated resistance and never met expectation is often justified by the statement that this information systems did not fit the organizational culture. This paper introduces and validates a four-stage socio-technical model coined as System Behavioral Success Model (SBS), which explains how the behavioral context of an IT organization led by their IT executives would lead to the success of the IS function. This was conducted by exploring the four dimensions: stretch, trust, support and discipline, as the shapers of organizational climate, and relates them to the IS success as represented by system performance, information effectiveness and service performance. Data were collected from 316 MSC status companies. The results show good support for the model. Except trust, organizational climate dimensions are proved to be major factor for the success of information systems in the organization, especially when the organization acts ambidextrously within the information systems context.

Keywords
Organizational climate, behavioral context, ambidexterity, IS success, system behavioral success model..

INTRODUCTION

This paper proposes and tests a model that attempts to provide a new insight of the linkage between organizational context and information systems success. This is performed by exploring the concept of organizational context dimensions suggested by Ghoshal and Bartlett [10] as the shapers of organizational climate, and relates them to the IS research, focusing on the IS success, particularly investigating the role of the managerial action affecting this linkage.

The System Behavioral Success Model (SBS) [3] is a socio-technical model describes a four stage process of how the behavioral context of an IT organization led by their IT executives would lead to the success of the IS function. The SBS model is presented in four stages. The first stage illustrates the managerial action of information system managers and IT executives to build a behavioral context in order to fulfill their managerial roles and processes. This stage will lead to stage two, where the managerial action produces a climate of behavioral context. Because of the information systems context in the organization possesses specific IT capabilities which is manifested from the adaptability and alignment, an organizational change will emerge as illustrated in stage three. The final stage four represents the stage where success of information systems function occurs as a result of this process.

THEORETICAL DEVELOPMENT

Organizational Context and IS Success

To test this model, tow main hypotheses have been developed from an in-depth review of the literature and intensive research investigations. IS success constructs suggested above are measured from the IS users' perspective that form the corporate culture of the organization. Ghoshal and Bartlett suggest that an organization can create and embed in its context a work ethic that induce rational and yet value-oriented actions on the part of its members [10]. This induces the creation of a favorable, supportive organizational context for improved organizational performance, and thus information systems effectiveness. This view manifests in the definition of organizational context by Ghoshal and Bartlett [10], as four behavioral attributes, which are created and reinforced by a variety of actions taken by managers in the organization. These attributes are: stretch, discipline, trust and support. Derived from the System Behavioral Success (SBS) Model, the conceptualized framework explains how the interaction of these four key dimensions will result in an organizational context that leads to an improved organizational information systems performance. Thus, it is hypothesized that:

H1: *The more that an organizational context is characterized by stretch, discipline, support, and trust, the higher the level of information systems success as captured by system performance, information effectiveness, and service performance.*

Ambidexterity and Performance

The structural context of these four behavioral attributes refers to the establishment of administrative mechanisms that foster certain behaviors in members of the organization, but its emphasis is on relatively tangible system and process such as managerial action. The argument is that the four behavior- framing attributes of discipline, stretch, support, and trust will create the organization context in which an ambidexterity emerges, a concept broadly referred to the organization's ability to do two different things at the same time [21], [1]. From this definition, the organization is aligned in order to respond efficiently to the demands of its existing

customers, and adaptive in order to meet emerging demands as they arise [11]. It is a balance between a pair of hard elements (discipline and stretch) and a pair of soft elements (support and trust). Thus, when a supportive organization context is created, organization members engage in an ambidexterity represented by both exploitation-oriented actions toward alignment, and exploration oriented actions toward adaptability, which results in contextual ambidexterity, and subsequently enhances organizational performance [11].

From this, it is suggested that ambidexterity mediates the relationship between the four attributes of organization context and subsequent information systems success used in the organization. That is, the attributes of organizational context influence IS success through the development of ambidexterity. This is because ambidexterity is seen as a meta-capability which is gradually developed over time through the interaction of the various features of an organization context. Ultimately, the four attributes shape individual and collective behaviors that in turn shape business-unit capacity for ambidexterity, and it is the ambidexterity that leads to superior performance of the IS function within the organization. Therefore, it is hypothesized that:

H2: *Organizational Ambidexterity mediates the impact of the organization context as captured by stretch, discipline, support, and trust, on the IS success as captured by system performance, information effectiveness, and service performance.*

MEASURE OF CONSTRUCTS

Sixty one items were used to measure the four organizational context constructs, namely stretch, discipline, trust and support. These items were previously developed and validated [3] before their inclusion to this model. The items used to measure the organizational ambidexterity constructs, namely alignment and adaptability, were adapted from Gibson and Birkinshaw [11]. To measure the IS success constructs, six items used to measures system performance were adapted from Chang and King [4], seven items measuring information effectiveness were adapted from DeLone and McLean [6], and four items measuring service performance were adapted from Chang and King [4]. All items of IS success constructs were measured using the scale: 1= to no extent, 2= to a little extent, 3= to some extent, 4= to a great extent, 5= to very great extent.

POPULATION AND SAMPLING

Multimedia Super Corridor (MSC) status companies were selected for this purpose. The MSC is developed specifically to explore the frontiers of information and multimedia technologies, revealing its full potential through the creation and implementation of cyber laws, cutting-edge technologies and excellent infrastructure. According to MDC [18], there are over 2173 approved MSC-status companies. Following the stratified proportion technique, the final sample drawn is 618 organizations

For data collection, web-based survey application called "Winsurvey", were used. IT managers, CIOs, executive level IT personnel of the MSC status companies will receive an e-mail containing the invitation letter and the link of the website address where the questionnaire is uploaded. Each link holds the unique ID number of that particular organization to keep track on the respondent. The data of that respondent will be uploaded to a MySQL database created in the server. This data will be retrieved and stored in the local machine as a MySQL database with the software interface.

RESULTS

Covariance-based SEM technique called Partial Least Squares (PLS) were used in this study because it is primarily intended for causal-predictive analysis in which the explored problems are complex and theoretical knowledge is scarce, and useful in a theory development situation[23],[5]. Following the PLS technique, the test of the model includes two stages: the measurement model, where the psychometric properties of the measures are evaluated in terms of reliability and validity. The second stage is the structural model, which involves the assessment of the path analysis of the theorized model.

The Measurement Model

Three tests were computed to assess the reliability, Cronbach's Alpha, composite reliability coefficient and average variance extracted (AVE). Hair *et al*. [13] suggested that both Cronabch's Alpha and composite coefficient should be equal of greater than 0.70 to represent good reliability, whereby in exploratory studies, a value of .60 may also be accepted [13]. As for AVE, a level greater than .50 is considered acceptable [5], [4].

Results show that all item loadings between an indicator and its posited underlying construct factor were greater than 0.7. Composite reliability of constructs all exceeded the criterion of 0.7, while the average variances extracted were above the recommended threshold of 0.5, adequately demonstrating convergent validity.

The Structural Model

WarpPLS 1.0 [15] was used for the analysis using a bootstrapping of 500 subsamples. WarpPLS software provides the P value, which is more meaningful than T values for hypothesis testing purposes. This is due to the fact that P values reflect not only the strength of the relationship, which is already provided by the path coefficient itself, but also the power of the test, which increases with sample size [15].

Two-stage analysis was conducted to analyze the mediation. In the first stage, a fully mediated model (i.e.,

no direct paths from discipline, support, trust and stretch to system performance, information effectiveness and service performance) was evaluated. This analysis is also to test the second hypothesis of this research (H2). In the second stage, direct paths from the four constructs, discipline, support trust and stretch, were introduced to examine the direct and mediated effects. This analysis is also used to test the first research hypothesis (H1). To statistically investigate the mediating effect, the two stage analysis mentioned above involves the three steps necessary for the mediation function [2], [11]. The first step is to establish that the independent variables (discipline, support, trust and stretch) significantly influence the mediator (organizational ambidexterity). The second step is to demonstrate that the independent variables (discipline, support, trust and stretch) influence the dependent variables (system performance, information effectiveness and service performance). The last step is to demonstrate that the mediator (organizational ambidexterity) influences the dependent variable. If, in this final step, the effect of organizational context constructs (discipline, support, trust and stretch) on information systems success constructs is no longer significant when the mediator is introduced to the model, full mediation is indicated. On the other hand, partial mediation is indicated if there is a substantial decrease for the contribution of the independent variable when the mediator is introduced. For full mediation the contribution has to decrease to a not significant level.

RESULTS AND DISCUSSION

As the results revealed[14], discipline has direct effect on system performance, information effectiveness and service performance. This study found that when discipline in the organization is high, the system performance and its effectiveness are high, as well as services of the IS function. This finding is consistent with recent research in the occupational commitment for IT professionals [12].

Support was also found to have a direct effect on system performance, information effectiveness and service performance. The finding of this study confirms the findings of previous studies emphasizing the importance of support as a behavioral capability for IT personnel, which lead to an efficient performance of the IS [7].

The findings of this research suggest the importance of trust in success of the IS in the organization. Some researchers examining the DeLone and McLean success model have also noted the importance of trust in the IS success. Jia *et al.* [14] even used trust as a scale to measure in the service quality construct. This finding also confirms the positive relationships between the quality of expertise trust and IT system success at a general level. When trust exists, the users are prepared to make efforts to ensure that output of the system and its service are interpreted appropriately [8], [9].

The study also suggests that when stretch exists within IS users in an organization, the IS will more likely be effective in terms of performance, and effectiveness. This is consistent with the findings of Watts and Henderson [22], that the motivation to achieve and strive toward a common organizational goal will enhance the IT innovation in the organization and translate the mutual vision into a technology vision and positively affect the system performance.

The findings of this research concerning ambidexterity are also consistent with previous studies that confirm the importance of ambidexterity to the success of the IS projects [16]. Not only that organizational ambidexterity has been associated with higher levels of IS organizational performance [17], but also successful IT managers tend to employ ambidextrous coping strategies to improve the adverse effects IS effectiveness. Looking at the elements of the organizational ambidexterity, alignment activities tends to improve the IS function in the short term, whereas adaptability activities tends to improve the IS function in the long term.

IMPLICATIONS

This paper has provided the answer of two main questions often concerns the IT managers and CIOs. The first question is does the behavioral context of the organization members has an effect on the outcome of the IS used in the organization? And if there is an effect, how can organizations enhance the IS effectiveness generated by the behavioral context of its members? These two questions are so important to the extent that IS effectiveness is consistently reported in the top 20 on the list of most important issues that concern the IS executives and managers. The answer to these two questions by presenting the SBS model clearly brings the explanation. For a better performance of the IS functions, managers and IT executives are requested to offer two main things in the organization: firstly, a purposeful action to harness the behavioral collective context in the IT business units. Secondly, facilitate an IT capabilities and infrastructure in which it provides the organization a capacity of change that blends the behavioral context into agility, which is a key factor of a successful IS projects.

CONCLUSION

This paper integrate the four key dimensions of Goshal and Bartlett that result in an organizational context, with the IS context in order to modify their structure to fit within the business IS aspect, and conceptualize them in a socio-technical model, which can be tested in further research. The System Behavioral Success Model (SBS) may open the door to more intensive research to fill this gap in this research.

[14] Tables are not provided here due to space limits. Results are provided upon request.

ACKNOWLEDGMENTS

The researcher would like to acknowledge the support of Center for Postgraduate Studies, Universiti Malaysia Sabah for this research, and the advisor of this research, Prof.Dr. Syed Azizi Wafa.

REFERENCES

[1] P. Adler, B. Goldoftas, D. Levine, "Flexibility versus Efficiency? A Case Study of Model Changeovers in the Toyota Production System," *Organization Science*, 10 (1999) 43-68.

[2] R. Baron, D. Kenny, "The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations," *Journal of Personality and Social Psychology*, 51 (1986) 1173-1182.

[3] Belkhamza, Z. "*Strategic Linkage between Organizational Context and Information Systems Success*" Unpublished PhD Dissertation, School of Business and Economics, Universiti Malaysia Sabah. (2010)

[4] J.C.-J. Chang, W. King, "Measuring the Performance of Information Systems: A Functional Scorecard," *Journal of Management Information Systems,* 22 (2005) 85–115.

[5] W. W. Chin. "Partial Least Squares is to LISREL as Principle Components Analysis is to Common Factor Analysis," *Technology Studies*, 2 (1995) 315-319

[6] W. DeLone, E. McLean, "The DeLone and McLean Model of Information Systems Success: A Ten-year Update," *Journal of Management Information Systems*, 19 (2003) 9–30.

[7] L. Fink, S. Neumann, "Gaining Agility through IT Personnel Capabilities: The Mediating Role of IT Infrastructure Capabilities," *Journal of the Association for Information Systems*, 8 (2007) 440–462.

[8] D. Gefen, "What Makes an ERP Implementation Relationship Worthwhile: Linking Trust Mechanisms and ERP Usefulness," *Journal of Management Information Systems*, 21 (2004) 263–288.

[9] D. Gefen, C.M. Ridings, "Implementation Team Responsiveness and User Evaluation of Customer Relationship Management: A Quasi-Experimental Design Study of Social Exchange Theory," *Journal of Management Information Systems*, 19 (2002) 47–69.

[10] S. Ghoshal, C. Bartlett, "Linking Organizational Context and Managerial Action: The Dimensions of Quality of Management," *Strategic Management Journal*, 15 (1994) 91–112.

[11] C. Gibson, J. Birkinshaw, "The Antecedents, Consequences, and Mediating Role of Organizational Ambidexterity," *The Academy of Management Journal*, 47(2004) 209–226.

[12] I. Guzman, R. Sharif, A. Kwiatkowska, Q. Li, "*Occupational Culture and Commitment in the IT Profession: A Multi-Country Perspective*," Proceedings of the 12th Americas Conference on Information Systems, Mexico (2006) 161-171.

[13] Hair, J. E., Anderson, R. E., Tatham, R. L., Black, W. C."*Multivariate Data Analysis with Readings*" Englewood Cliffs, N.J: Prentice Hall. (2010)

[14] R. Jia, B.H. Reich, M. Pearson, "IT Service Climate: An Extension to IT Service Quality Research," *Journal of the Association for Information Systems*, 9 (2008) 294–320.

[15] N. Kock, *WarpPLS 1.0 User Manual*, Laredo, Texas: (2010)

[16] G. Lee, W. DeLone, A. Espinosa, "Ambidextrous Coping Strategies in Globally Distributed Software Development Projects," *Communications of the ACM*, 49 (2006) 40.

[17] H. Ling, F. Zhao, Y. Wang, "*Impact of Synergy between IT and Business Process on Organizational Performance: a Perspective of Ambidexterity Theory,*" Proceedings of PACIS 2009, (2009).

[18] MDC. *MSC Malaysia Status Companies*. http://www.mscmalaysia.my (2008). Retrieved June 2009

[21] M. Tushman, C. O'Reilly, "Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change," *California Management Review*, 38(1996) 8-30.

[22] S. Watts, J.C. Henderson, "Innovative IT climates: CIO perspectives," *Journal of Strategic Information Systems*, 15 (2006)125–151

[23] H. Wold., "*Partial Least Squares*," in Encyclopedia of Statistical Sciences, S. Kotz and N. L. Johnson (eds.) Wiley, New York, (1985) 581-591

Membranes for Ester-based Aromas Recovery: A Review

Rosalam Sarbatly[1] Chiam Chel Ken[2]
Membrane Technology Research Group, Centre of Materials and Minerals, School of Engineering and Information Technology, Universiti Malaysia Sabah, 88999 Kota Kinabalu, Sabah, Malaysia.
E-mail: [1] rslam@ums.edu.my, [2] qiujingchiam@gmail.com

Abstract
The purpose of this review paper is to study the ester-based aromas recovery from water by vacuum membrane distillation. Fluoropolymeric and polyolefin membranes can concentrate the ester aromas by rejecting the water because of their hydrophobic properties. The study found that the resistance to mass transfer of vapors increased with the thickness and reduced with the porosity for the all membrane materials. The organophobic polytetrafluoroehtylene (PTFE) and polyvinylidene fluoride (PVDF) membranes with pore sizes between 0.1 and 0.6μm that give high flux and no pore wetting are suitable to recover the low boiling esters (<100°C). Low selectivity by the larger pore sizes (>0.1 μm) results in low purity of the ester(s) in permeate due to the vapors of ester(s) and water transport simultaneously through the membranes. The partial organophilic PVDF membrane with pore sizes between 0.01 and 0.05μm and the fully organophilic polyolefin membrane with pore sizes between 0.03 and 0.2μm, respectively, are appropriate to recover the high non-polarity and low non-polarity of esters from the water. There is an optimum pore size within the range from 0.03 to 0.2μm of the polyolefin membrane which can selectively recover the high boiling esters (>100°C) with high fluxes.

Keywords
Polymer; Membrane; Ester aromas; Vacuum membrane distillation; Mass transfer

INTRODUCTION
Aromas play a key role to increase the appeal of the juice products. The natural aromas are volatile compounds which tend to release in the vapor phase at high temperatures especially during the juice concentration process in a multi-stage vacuum evaporator. The loss of the organoleptical properties results in a low marketable quality of the juice products. An effort to improve the flavor quality of the final products is to recover the volatile aroma compounds from the condensate and then re-add the recovered aroma compounds into the concentrate juice. A high temperature distillation process has traditionally performed to recover the volatile aromas from the aqueous condensate. But the high thermal effect increases the possibility of aromas spoilage in terms of nutrients and colors degradation. Additionally, the distillation process is a high energy consumption technology which leads to an increase in operating cost. As a consequence, further research on alternative technologies for the recovery of volatile aroma compounds from the condensate is required.

Membrane processes have been considered as alternatives in the juice industry. A membrane system requires a relatively low temperature and pressure to accomplish a separation resulting in low energy consumption. The membrane separation processes are attractive for the production of high quality fruit juices coupled with less demands on mechanical parts installation. In recent years, the membrane processes that have been evaluated in the aroma compounds recovery are pervaporation [1], membrane air-stripping [2] and vacuum membrane distillation [3]. The overall mass transfer resistance reduces in a vacuum-based membrane separation system leads to an increase in the aroma compounds recovery. Pervaporation utilizes a dense membrane results in a high mass transfer resistance which give a low flux but a high selectivity. On a contrast, the microporous membranes in membrane air-stripping and vacuum membrane distillation are less selective because the membrane materials that are commonly used play no significant role in the separation.

An idea is arisen where to recover the aromas by a microporous membrane coupled with a consideration of the interaction between the moiety of the aromas and the properties of the membrane. The aromas of juices individually differ in solubility, boiling point and volatility where the molecular structures and the functional groups of the aromas determine these properties. The structures classify the aromas into the linear terpenes, cyclic terpenes, esters, aromatic, amines, carbonyl compounds and alcohols. The use of a right membrane material and properties which is having a good adhesion and a low mass transfer resistance to the aromas can recover more aromas from the condensate. Initially, the aromas adsorb on the membrane surface and vaporize into the membrane pores and finally diffuse through the membrane. The objective of this review was to study the effects of physical and chemical properties of the microporous membrane on the mass transfer of the ester-based aroma compounds in the vacuum membrane distillation.

CHEMISTRY OF ESTER AROMAS
The organic esters are covalent compounds. A dipole moment within an ester molecule does exist due to a difference in electronegativity of atoms within the molecule. There is a degree of molecular polarity

which arises from the electrons sharing by the charged atoms within the molecule. Consequently, intermolecular forces exist between the molecules which in turn define the solubility of the ester in polar and non-polar media. The organic ester is a carboxylic acid derivative where an alkyl or aril group replaces the hydrogen atom in –COOH. Therefore ester is more volatile than carboxylic acid as well as alcohol as a result from the absence of the hydroxyl group. The small esters are volatile liquids and fairly soluble in water. However the solubility in water decreases greatly when the number of carbon chains increases. These esters are colorless and have fruity smells. In nature, the ester-based aromas can be found in fruits, flowers and the byproducts of fermentation. Table 1 shows some examples of the ester-based aroma compounds.

Table 1. The physical properties of several ester-based aroma compounds

Aroma compound	Density (g/cm^3)	Molecular weight (g/mol)	Boiling point (^oC)
Methyl formate	0.989	60.05	32
Methyl acetate	0.932	74.08	56.9
Ethyl acetate	0.897	88.11	77.1
Ethyl butyrate	0.879	116.16	121
Butyl acetate	0.880	116.16	126
Hexyl acetate	0.867	144.21	171.5
Isoamyl acetate	0.876	130.19	142
Octyl acetate	0.873	172.27	211

MEMBRANE SYSTEM FOR AROMAS RECOVERY

Consider the ester-based aroma compounds dissolved at a low concentration due to the solubility nature in an aqueous condensate where water is the major component. For a membrane process to recover the aromas from the condensate, the ester aromas are designed as the target components to transport through the membrane. Therefore the membrane separation system requires a hydrophobic membrane which preferentially repels the water molecules but allow the esters to diffuse.

VACUUM MEMBRANE DISTILLATION

Membrane distillation is a thermally driven process in which only volatile molecules transport through the hydrophobic and microporous membranes. The feed solution at which temperature ranges from 20 to 80^oC [4] is brought into direct contact with a gas phase through the membrane without allowing one phase to disperse into other as illustrated in Figure 1. The membrane basically acts as a physical support for the gas-liquid interface and prevents the separation process from being reversible. The membrane does not permit the liquid to enter the gas-filled pores until the critical pressure of the membrane is exceeded. A vacuum is applied on the permeate side resulting in a mass transfer where the vapor of an ester always transports through the membrane due to the Gibbs free energy in the feed solution reduces over time. The mass transfer obeys the second law of thermodynamics because the pressure on permeate side is lower than the saturation pressure of the ester. The ester vapor is collected at outside of the membrane module by condensation.

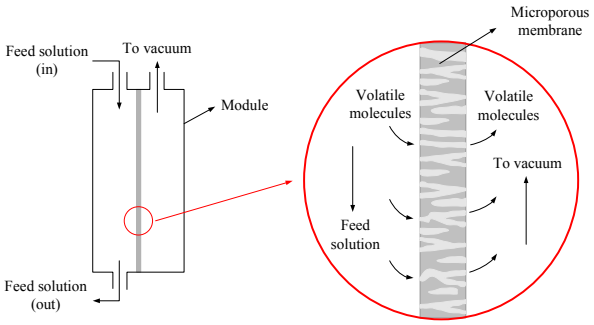


Figure 1. Vacuum membrane distillation

PHYSICAL PROPERTIES OF A MEMBRANE

Thickness

Mass transfer resistance increases in a thicker membrane. The ester molecules resist diffusing as long as there are collisions in the membrane gas-filled pores. Initially, these molecules carry energy when they enter the pores and then they lose energy after every collision. At every collision, the momentum of the molecules is changed according Newton's second law of motion. A great pressure drop indicates a conductive energy loss increases which resulting in a lower permeate flux through the membrane. In reality, the pore is tortuous where the pressure drop is greater than the straight pore.

Porosity

The energy flux for transporting the ester molecules is lost to the membrane pore walls by conduction. The ester recovery would be low or zero when using a membrane with low porosity. A high porosity membrane is preferable because the thermal conductivity of the ester vapor is smaller than that of the polymer. A factor of porosity-tortuosity should be taken into account in permeate flux calculation.

Pore Size

One criterion of ester recovery efficiency is the membrane pore size. The microporous membrane pore size ranges from 0.01 to 1μm. The mass transfer of ester is low and even no separation if there is a pore wetting. The liquid surface tension supports the pressure drop across the gas-liquid interfaces in preventing the liquid penetration in the pores. This implies the concentration of ester dissolved in the water is also a critical problem because organic compounds tend to lower the water surface tension. Schneider et al. have recommended the maximum pore size of about 0.5 to 0.6μm might be used to avoid the

pore wetting and with a sufficient safety tolerance consideration of pressure and temperature fluctuations [5].

In vacuum membrane distillation, Knudsen diffusion mechanism governs the mass transfer of ester as a result of a partial pressure gradient of the ester exists across the membrane in addition to the mean free path λ of ester is equal or greater than the membrane pore size. The ester molecules collide with the pore wall rather than with other molecules in the pores. This mechanism usually prevails in the membranes that are having pore size of 0.2μm for various volatile compounds [6-7]. But frequently in practical, the mass transfer mechanism falls into transition region between Knudsen diffusion and viscous flow [8-9] because the majority of pore sizes in the membrane are between 0.1λ and 100λ. The viscous flow is due to a difference in hydraulic pressure between the feed and permeate. Thus, when the Knudsen-viscous transition is the prevailing mechanism, the ester molecules collide with the pore walls and with each others in the pores.

MEMBRANE MATERIALS AND SELECTION

A fluoropolymer is relatively organophobic as a result of high electronegativity in the carbon-fluorine (C-F) bonds. Ionic characters rather than van der Waals interactions appear more in the carbon-fluorine bonds. The bonds become stronger when the carbon is saturated with fluorine atoms. For instance the monomer of polytetrafluoroethylene (PTFE) is $–CF_2CF_2–$ in which the carbon-fluorine bonds make the membranes to be highly organophobic. There are no specific interactions between the PTFE and the ester as well as the water. In the vacuum membrane distillation, the ester and water vaporize in the feed solution and transport simultaneously through the membrane pores. The total flux of the vapors is the highest when the pore sizes in the membranes are as large as not exceeding the recommended maximum pore size of 0.6μm, on the contrary, the total flux decreased with the pore sizes. The pore sizes of PTFE membranes have been evaluated in the recovery of the volatile aroma compounds from black currant juice were 0.1μm and 0.2μm [3,10]. However the selectivity is relatively low especially when the membrane recovers the esters having higher boiling points than the water. Furthermore the low boiling esters such as methyl formate, methyl acetate and ethyl acetate will be more selectively recovered by the PTFE membranes as compared to the high boiling esters.

A fluoropolymer contains the carbon-hydrogen bonds is partially organophilic such as the polyvinylidene fluoride (PVDF) membrane where the monomer is –CHFCHF–. The interactions by the van der Waals forces between the PVDF membrane and non-polar compounds become significant only when the pore sizes are between 0.01 and 0.05μm [11-13]. The PVDF membranes can recover efficiently for both low and high boiling non-polar organic compounds, 56.5 to 145^oC [11] like some esters shown in Table 1. Therefore the recovery of esters relies on the solubility in the PVDF membranes. The sorption of esters contributes significantly to the mass transfer of esters when the number of carbon chains increases in the esters. The selectivity is higher for the PVDF membranes compared with the PTFE membranes because the flux of water vapor is reduced greatly by the small pore sizes. Recovery of the esters which are high in non-polarity can plasticize and swell the PVDF membranes structures. As a result, the pore size becomes larger and allow for higher water vapor flux. There was no significant sorption has been reported when pore sizes were between 0.1 and 0.22μm [14-15] in which the organophobic carbon-fluorine bonds might be the dominant effect in the PVDF membranes.

Polyolefin membranes are highly organophilic and hence result in a high selectivity. Dispersive adhesion or sorption is the main mechanism contributes to the esters recovery. This mechanism attributes the intermolecular interactions between the membranes and esters where the adhesion increases in esters and decreases in water. Diban et al. proposed the surface diffusion and Knudsen diffusion governed the mass transfer of the ester and water, respectively, when polypropylene was used as the membrane material [16]. The interaction between an ester and a polyolefin membrane becomes stronger when the number of carbon chain increases in the polyolefin or in the esters. Esters with higher boiling points than the water, for example ethyl butyrate, butyl acetate, hexyl acetate, isoamyl acetate and octyl acetate are more appropriate to be recovered by polyolefin membranes. A high purity of an ester can be achievable because the use of a relatively small pore size can reduce the water vapor flux. But an organic compound that having a strong affinity with a membrane and which the membrane is having a pore size as small as 0.03μm can result in a substantial mass transfer reduction due to pore blockage [17]. However the pore blockage was not observed for a larger pore size of 0.2μm [18].

CONCLUSIONS

Properties of the microporous and hydrophobic membranes for several ester-based aroma compounds recovery and purification by vacuum membrane distillation have been reviewed in this paper. For all types of membrane materials, the mass transfer of vapors reduced with the thickness but increased with the porosity. The highly organophilic polyolefin membranes give high selectivity and low flux because the pore sizes are relatively small. Therefore a further investigation is required to estimate an optimum pore size within the range of between 0.03 and 0.2μm that can give high selectivity and high flux for the high boiling esters (>100^oC). Two-stage vacuum membrane distillation can perform to increase the amount of the low boiling esters (<100^oC) from water. The first stage

should consist of a PTFE or PVDF membrane with the selection of pore size between 0.1 and 0.6μm which is based on the pore wetting condition. The membrane in the second stage must be having a role in esters recovery by sorption; hence the swelling and pore blockage should be taken into account. The partial organophilic PVDF membranes with pore sizes between 0.01 and 0.05μm are suitable to recover the strong non-polar esters; whereas the polyolefin membranes with pore sizes between 0.03 and 0.2μm are appropriate to recover the weak non-polar esters.

ACKNOWLEDGMENTS

We are grateful for the support of the Ministry of Higher Education Malaysia (Research grant FRG0207-TK-1/2010).

REFERENCES

[1] A. Aroujalian, A. Raisi, *J. Membr. Sci.*, 303 (2007) 154-164.
[2] F. Gascons Viladomat, I. Souchon, V. Athès, M. Marin, *J. Membr. Sci.*, 277 (2006) 129-136.
[3] R. Bagger-Jørgensen, A.S. Meyer, C. Varming, G. Jonsson, *J. Food. Eng.*, 64 (2004) 23-31.
[4] M.S. El-Bourawi, Z. Ding, R. Ma, M. Khayet, *J. Membr. Sci.*, 285 (2006) 4-29.
[5] K. Schneider, W. Hölz, R. Wollbeck, S. Ripperger, *J. Membr. Sci.*, 39 (1988) 25-42.
[6] A.M. Urtiaga, G. Ruiz, I. Ortiz, *J. Membr. Sci.*, 165 (2000) 99-110.
[7] S. Bandini, G.C. Sarti, *Desalination*, 149 (2002) 253-259.
[8] K.W. Lawson, D.R. Lloyd, *J. Membr. Sci.*, 120 (1996) 111-121.
[9] M.S. El-Bourawi, M. Khayet, R. Ma, Z. Ding, X. Zhang, *J. Membr. Sci.*, 301 (2007) 200-209.
[10] V. Soni, J. Abildskov, G. Jonsson, R. Gani, *J. Membr. Sci.*, 320 (2008) 442-455.
[11] K. Jian, P.N. Pintauro, R. Ponangi, *J. Membr. Sci.*, 117 (1996) 117-133.
[12] K. Jian, P.N. Pintauro, *J. Membr. Sci.*, 135 (1997) 41-53.
[13] M. Khayet, T. Matsuura, *AIChE J.*, 50 (2004) 1697-1712.
[14] N. Couffin, C. Cabassud, V. Lahoussine-Turcaud, *Desalination*, 117 (1998) 233-245.
[15] B. Wu, X. Tan, K. Li, W.K. Teo, *Sep. Purif. Technol.*, 52 (2006) 301-309.
[16] N. Diban, O.C. Voinea, A. Urtiaga, I. Ortiz, *J. Membr. Sci.*, 326 (2009) 64-75.
[17] H. Mahmud, A. Kumar, R.M. Narbaitz, T. Matsuura, *J. Membr. Sci.*, 209 (2002) 207-219.
[18] R.S. Juang, S.H. Lin, M.C. Yang, *J. Membr. Sci.*, 255 (2005) 79-87.

Petrography and Reservoir Characteristics of the Belait Formation, Labuan Island

Hafzan Eva Mansor[1,*], Sanudin Tahir[1] and Baba Musta[1]
[1]School of Science and Technology, University Malaysia Sabah (UMS),
Locked Bag 2073, 88999 Kota Kinabalu, Sabah.
*hafan_eva@yahoo.com

Abstract
The sedimentary sequence investigated constitutes part of the Belait Formation represented by porous sandstone facies of the Lower Miocene age. This study tends to characterize the facies, petrography and petrophysical properties of the formation using integrated outcrop facies analysis, petrographic, and petrophysical analysis. The facies analysis revealed that the Belait Formation is deposited in shallow marine and fluvial environment. Petrographic analysis then reveled that those sandstone facies are sublitharenite, very fine to fine grained, texturally and mineralogically mature, and moderately well sorted. The major constituent throughout the Belait sandstone is monocrystalline quartz, with the proportion in the framework grains ranges between 65%-75%. Other framework grains are feldspar (very low percentage to absent), chert, clay minerals (illite, kaolinite, and calcite), and rocks fragments. However, their porosity and permeability vary significantly, where the porosity value ranges from 6.3% to 29.9%, and permeability ranges from <0.01md to 618.00md. In contrast to the generality that high porosity–permeability often corresponds to large grain sizes and sorting index, the porosity–permeability here show no good correlations to both parameters, suggesting the presence of remarkable textural heterogeneity. Reservoir quality is thus largely controlled by pore occluding cement, textural parameters (grain size, pore size, and sorting) and depositional environments which exerted an essential control.

Keywords
Belait Formation, facies, petrography, reservoir, porosity, permeability

INTRODUCTION

This surface outcrop study focuses on the integration of petrography and reservoir potential investigation as an aid in delineating the mineralogical, provenance and reservoir characteristics of the sandstone facies (aged Middle Miocene to Pliocene) of the Belait Formation, Labuan Island, Malaysia. The stratigraphic relation of the Belait Formation in Labuan is as shown in Figure 1 and 2. The area of investigation encompasses the most of the northern part of the island (see Figure 1 for the location of the study area). The Belait sediments are dominantly represented by siliciclastic, and representing a wide range depositional settings including shallow marine to fluvial environments. It is also considered to have a considerable hydrocarbon and groundwater potential because according to Mazlan (1996), this unit is the lateral equivalents of some of the hydrocarbon reservoirs in the offshore areas of North West Sabah. Moreover, the characteristics of thick sediments in this succession are similar to many of the major Miocene and Pliocene oil reservoir rocks in Malay Basin and the most studied and prospected lithostratigraphic units in the Neogene basins due to their hydrocarbon productivity. The Belait Formation have been studied but not in detail and various aspects of this formation makes them worth to be a part of detail investigation, which will later help in the better understanding in terms of petrology, major aquifer and expected hydrocarbon reservoirs of the Labuan Island.

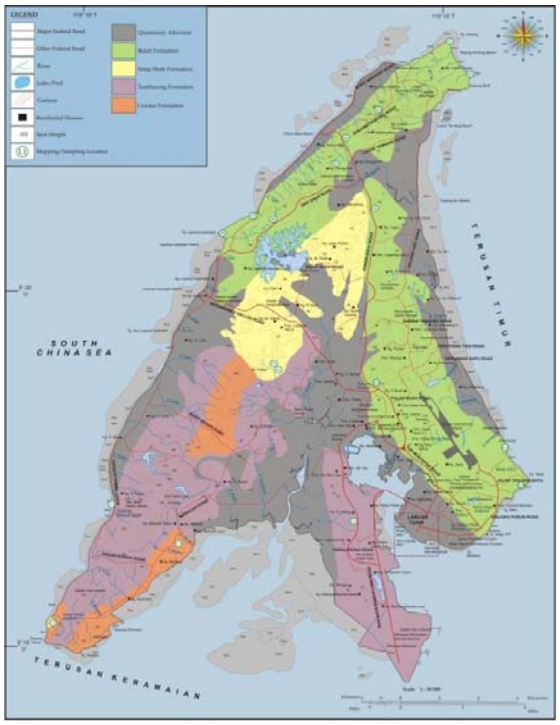


Figure 1. Geological map of the Labuan Island

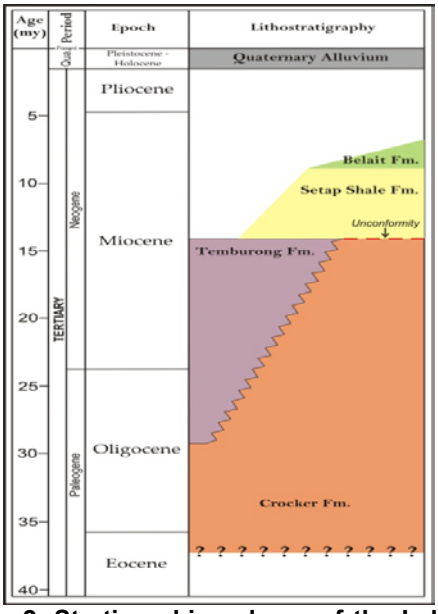


Figure 2. Stratigraphic column of the Labuan Island

MATERIALS AND METODOLOGIES

Lithofacies analysis was carried out based on twelve surface outcrops. Thus, selected sandstone facies (Facies A1, A2, A3, A4, A5, B1, C1 and Subfacies D1b) from the Belait Formation were studied for reservoir evolutions using petrographic and petrophysics (porosity and permeability) approaches. For petrographic studies, twenty fresh sandstone samples were conducted for conventional thin sections preparations, and the other six were impregnated with blue epoxy prior to cutting and grinding to a standard 30µm thickness. Grains, cements and pores were counted, and they were tallied thus a percent was calculated for total count per item over the number of total counts, which was usually about 200 points. This was done randomly using mechanical stage. Eight sandstone samples were conducted for XRD analysis of the clay fraction ≤2µm by using Phillip X'Pert PRO PW3040/60 Diffractometer (XRD MPD), and SEM methods using a HITACHI 3000S SEM machine. For porosity and permeability analysis, 22 plugs were drilled from rock samples (representing eight different facies of the Belait Formation). Porosity and permeability were determined for all plugs using CMS-300 machine, together with nitrogen and helium-driven bottles. Three orientations were measured on each samples; parallel to bedding, perpendicular to bedding, and opposite to bedding.

FACIES CLASSIFICATION

The overall stratigraphy of the Belait Formation consist of six packages of repetitive upward coarsening sequence; from basal very fine sandstone, to conglomeratic sandstone, to coal, to mudstone (siltstone, claystone, or shale), and capped by very thick fine sandstone. In this paper, facies distributions of the Belait Formation were based on Hafzan *et al.* (2010). The Belait Formation can be divided into four main group of facies (Facies A to D in ascending order) as listed below. Facies A was the dominant group of facies distributed in the Belait Formation.

a) Cross-stratified Sandstone (Facies A) – Facies A1 (tabular planar cross-stratified sandstone), Facies A2 (through cross-stratified sandstone), Facies A3 (hummocky cross-stratified sandstone), Facies A4 (swalley cross-stratified sandstone), and Facies A5 (herringbone cross-stratified sandstone).
b) Laminated Sandstone and Mudstone (Facies B) – Facies B1 (laminated sandstone), and Facies B2 (laminated mudstone).
c) Bioturbated Sandstone (Facies C) – Facies C1 (bioturbated sandstone, and Facies C2 (bioturbated sandstone).
d) Non-bioturbated Sandstone (Facies D) – Facies D1 (Coarsely interlayered bedding of massive sandstone and mudstone. This facies can be subdivided into three subfacies – Subfacies D1a (sandstone and mudstone bedding are almost equally thick), Subfacies D1b (thicker massive sandy layers are separated by thin clayey or finer-grained layers), and Subfacies D1c (thicker massive mudstone alternated with relatively thin sandstone layers). Other type of facies in this category are Facies D2 (amalgamated sandstone), Facies D3 (pebbly to conglomeratic sandstone), and Facies D4 (Coal).

PETROGRAPHIC ANALYSIS

The modal composition determined from thin sections under a petrological microscope for the Belait sandstones are given in Table 1. Composition of this sandstone is very uniform, with normalized major framework components of quartz, trace of feldspar, and some rock fragments. The sandstone of the Belait Formation is sublitharenites.

Quartz (Qz) occurs in abundance, and predominantly monocrystalline (Qm). Other secondary and accessory minerals include feldspar, chert, and rock fragments. Sandstone samples of the study area contained rock fragments, but the majority grains are individual crystals like polycrystalline and monocrystalline quartz. The proportion of quartz in the framework grains varies from 78.08% and 92.25%, with a mean of 86.01%. The monocrystalline quartz ranges from 67.14% and 67.14% (with a mean of 61.09%), whilst the polycrystalline quartz ranges from 17.36% and 31.51% (with a mean of 24.92%). The quartz fragment shapes varies from subrounded to well-rounded with moderate to high sphericity, undulatory extinction,

occur as clusters of anhedral grains by which the clusters ranges in size from 0.1mm to 0.7mm. Thus, the quartz grains also show point, concave, and convex contacts with each other, and also exhibit a medium degree of maturity. Chert grain is the second most common component in the Belait sandstone. In most samples, its constituent can reach up to 19.5%. For the purpose of counting, chert fragments were included in the polycrystalline quartz (Qp) counts.

Feldspar grain is rather rare and absent in most of the samples. The range of feldspar content is only from 0.0% to 1.57%. Besides, the finer breakdown products of the original rocks (which is well-known as lithics or matrix), formed during weathering and consisting of mainly clay minerals form the matrix to sandstone (Tucker, 1991). Lithics in the Belait sandstones were consist of polycrystalline quartz grains (Qp), cherts, clay, and carbonaceous materials. The major differences occur in the relative amounts of cement, including quartz overgrowth, and authigenic minerals (as detected using X-ray diffraction XRD analysis and SEM microphotograph). There are three types of authigenic clay minerals observed – kaolinite, illite, and calcite. Kaolinite occurs similarly like 'book sheets', and exists in oversized pores. Kaolinite is a minor constituent in many of marine sandstone, and can be well-observed in sample from Facies B1, C1, and D1. Its morphology appears to be restricted to the smaller booklets. Authigenic illite has been identified once in sample from Facies B1.

Table 1. Summary of detrital minerals distribution based on 200-point modal counting and petrophysic data for the Belait sandstone Facies, Labuan Island

Facies*	Sample	Petrography Analysis											Reservoir Potential		
		Chert (%)	Clay (%)	Matrix (%)	Pore (%)	Cement (%)	Mineralogy of Grains (%)					Classification	Poro-sity (%)	Permea-bility (mD)	RQI
							Quartz (%)			F (%)	L (%)				
							Qm	Qp	Qt						
A1	a	12.5	9.5	9.5	5.5	5.5	67.14	20.71	87.86	0.00	12.14	Sublitharenite	25.2	452.00	1.330
	b	15.5	6.5	11.0	4.5	7.0	65.49	26.76	92.25	0.70	7.04	Sublitharenite	24.8	618.00	1.567
	c	18.5	7.5	8.0	6.0	4.5	52.03	29.05	81.08	0.68	18.24	Sublitharenite	25.3	598.00	1.527
A2	a	15.0	10.5	9.5	6.0	4.0	60.00	27.14	87.14	0.00	12.86	Sublitharenite	20.3	143.00	0.833
	b	10.0	11.5	13.5	4.0	7.5	61.42	23.62	85.04	1.57	13.39	Sublitharenite	21.6	112.00	0.715
	c	9.0	7.5	8.0	7.5	8.5	66.42	21.17	87.59	0.00	12.41	Sublitharenite	20.8	80.80	0.619
	d	10.5	8.5	9.5	5.0	5.0	61.81	17.36	79.17	0.00	20.83	Sublitharenite	-	-	-
A3	a	15.5	6.5	7.5	7.0	9.0	61.43	25.00	86.43	0.71	12.86	Sublitharenite	20.0	7.91	0.197
	b	10.5	8.0	10.5	5.5	5.5	66.67	19.86	86.52	0.00	13.48	Sublitharenite	19.7	14.40	0.268
	c	9.5	9.5	11.5	5.0	5.0	65.22	18.84	84.06	0.72	15.22	Sublitharenite	19.8	14.60	0.270
	d	12.0	11.5	10.0	4.0	6.5	58.82	25.00	83.82	1.10	15.07	Sublitharenite	-	-	-
A4	a	11.0	12.5	5.0	4.5	8.0	61.43	19.29	80.71	0.00	19.29	Sublitharenite	19.8	53.20	0.515
	b	11.5	11.5	14.5	5.5	6.0	60.80	22.40	83.20	0.00	16.80	Sublitharenite	20.1	90.70	0.667
	c	15.5	13.5	8.0	3.0	4.5	59.15	29.58	88.73	0.00	11.27	Sublitharenite	19.7	85.60	0.655
	d	15.0	14.5	9.5	2.5	3.5	55.71	27.86	83.57	0.00	16.43	Sublitharenite	-	-	-
A5	a	17.5	13.5	6.5	3.5	7.0	58.27	30.94	89.21	0.00	10.79	Sublitharenite	19.1	27.10	0.374
	b	14.5	9.5	10.0	4.5	4.0	60.42	27.08	87.50	0.69	11.81	Sublitharenite	19.9	39.46	0.442
	c	17.5	13.0	6.5	5.0	4.0	57.34	29.37	86.71	0.00	13.29	Sublitharenite	-	-	-
	d	13.5	15.0	9.5	2.5	5.5	65.93	23.70	89.63	0.00	10.37	Sublitharenite	-	-	-
B1	a	13.0	9.5	6.0	7.0	4.5	57.53	20.55	78.08	0.00	21.92	Sublitharenite	17.7	3.36	0.011
	b	16.5	12.0	6.5	6.0	3.5	54.86	28.47	83.33	1.04	15.63	Sublitharenite	18.2	7.11	0.013
	c	14.0	9.5	8.5	4.5	6.5	61.97	26.06	88.03	0.00	11.97	Sublitharenite	17.5	4.85	0.137
C1	a	10.5	17.5	5.0	5.0	3.0	65.47	19.42	84.89	0.00	15.11	Sublitharenite	8.7	<0.01	0.196
	b	11.0	15.5	4.5	3.0	7.5	67.63	17.99	85.61	0.00	14.39	Sublitharenite	6.3	<0.01	0.165
	c	16.0	16.5	8.5	4.5	5.0	58.02	27.48	85.50	0.76	13.74	Sublitharenite	-	-	-
	d	15.5	20.5	6.5	4.5	4.0	62.02	26.36	88.37	0.00	11.63	Sublitharenite	-	-	-
D1b	a	19.5	7.5	10.5	4.0	3.5	59.73	30.87	90.60	0.00	9.40	Sublitharenite	29.9	462.00	1.234
	b	18.5	6.5	7.5	2.5	5.5	60.26	29.49	89.74	0.00	10.26	Sublitharenite	29.9	449.00	1.217
	c	18.0	7.5	9.5	5.5	4.5	56.85	31.51	88.36	0.00	11.64	Sublitharenite	30.0	339.00	1.056
	d	13.5	11.5	11.0	4.5	4.5	62.77	24.82	87.59	0.73	11.68	Sublitharenite	-	-	-

*Note: A1 = Tabular planar cross-stratified sandstone, A2 = Trough cross-stratified sandstone, A3 = Hummocky cross-stratified sandstone, A4 = Swalley cross-stratified sandstone, A5 = Herringbone cross-stratified sandstone, B1 = Laminated sandstone, C1 = Bioturbated sandstone, and D1b = Coarsely interlayered bedding of massive sandstone and mudstone, Qm = monocrystalline, Qp = polycrystalline, Qt = Quartz total, F = feldspar, RF = rock fragments, RQI = Reservoir Quality Index

RESERVOIR POTENTIAL ANALYSIS

Porosity measured on outcrop samples ranges from 8.7% to 30.0. Porosity in all the sandstone samples is predominantly inter-granular, with a significant amount of intra-granular porosity, and oversized pores. Inter-granular pores are the most significant for the storage and transmissibility of fluids. Intra-granular pores on the other hands results principally from dissolution within feldspar grains and rarely in rock fragments (Mancini *et al.,* 1990), and most quartz grains in areas of secondary porosity have point contacts and corroded, etched surfaces. Quartz is the more pore occluding cement and generally occurred as small euhedral crystal, locally as large pyramidal crystal in the primary pores. Pressure solution derived from grain contact is the main contributor to quartz overgrowth. Microporosity is associated with the presence of clay minerals such as illite and kaolinite.

Measured air permeability (est.) is ranges from <0.01md to 618.00md Samples with permeability less than 10.0md have a fluctuated percentage of porosity, ranges from 8.0% to 20.0%. According to Tiab and Donaldson (2004), the permeability of a rock depends on its effective porosity; consequently, it is affected by the grain size, grain shape, sorting, grain packing, and the degree of consolidation and cementation. In the Belait sandstone facies, many textural
and compositional factors are supposedly governing, both, porosity and permeability. The very low permeability value of Facies C1 is due to high content of clays and cement volume is very high. In order to gain a better understanding on porosity and permeability controls, a Reservoir Quality Index (RQI) was calculated and shown in Table 1. RQI value ranges from 0.011 to 1.567, with a mean of 0.637.

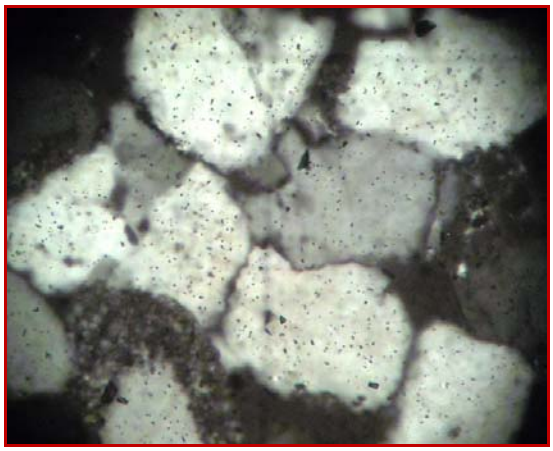


Figure 3. Thin section slide showing quartz grains are the most dominant minerals in Facies C1, tightly cemented by calcite mineral and matrix. Pore spaces were also corroded and filled with matrix and clays (presents as detrital matrix)

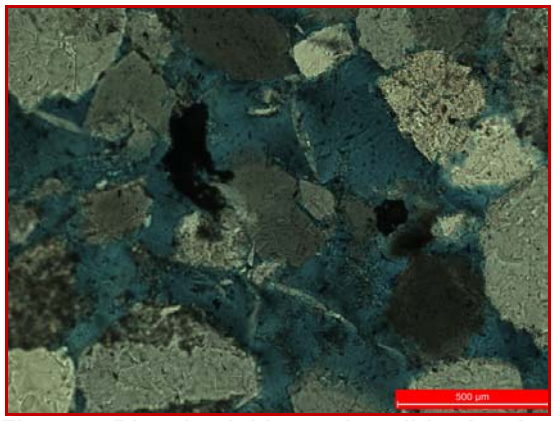


Figure 4. Blue-dyed thin section slide showing highly porous and permeable Subfacies D1. The blue area represents pore spaces. Its intergranular porosity showing both catenary pore and cul-de-sac type of effective porosity

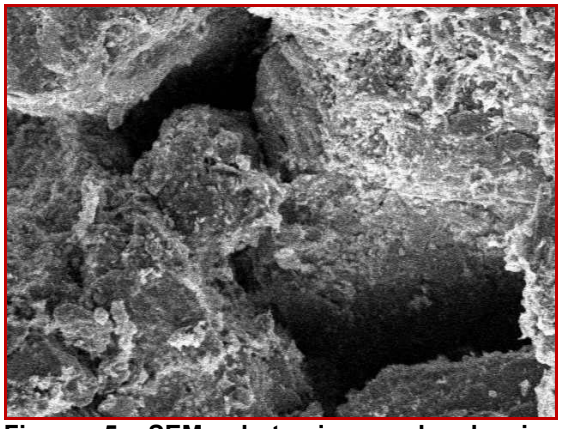


Figure 5. SEM photomicrograph showing oversized pore of Facies A3, giving high percentage of porosity. But most of its pore were not connected resulting very low permability

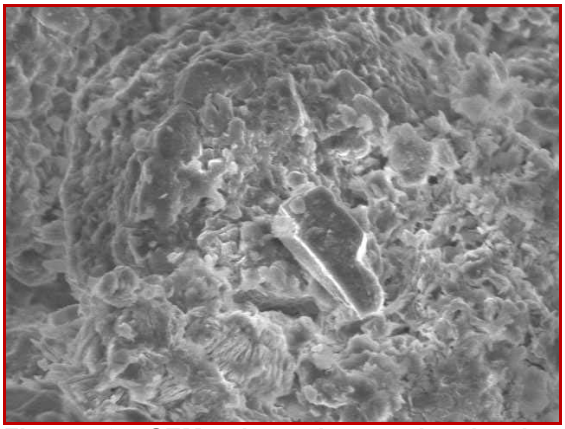


Figure 6. SEM photomicrograph showing small quartz grain surrounded by fibrous habit of illite and kaoline

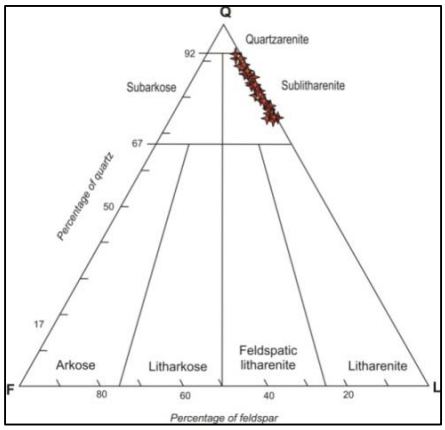


Figure 3. Detrital classification of the Belait sandstone facies (plotted in the right half of Folk (1968) diagram)

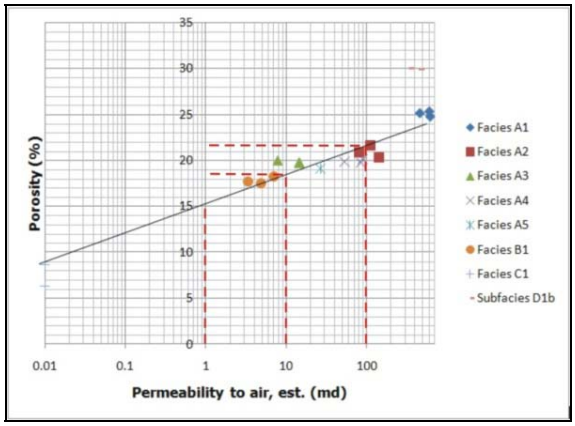


Figure 4. a) Typical porosity-permeability graph shows 1mD permeability is equal to 15% porosity

CONCLUSION

a) Maturity of the Belait sandstone is mainly provenance related.
b) Sandstone provenance for the Belait Formation was probably located within an orogenic tectonic belt.
c) Reservoir quality is controlled by pore occluding cement, textural parameter (grain size, pore size, and sorting), and depositional environment.
d) The best reservoir quality occurs in fine-grained sandstone dominated facies (Subfacies D1 – coarsely interlayered bedding of massive sandstone and mudstone).

ACKNOWLEDGEMENT

This research was supported by the University Malaysia Sabah (Postgraduate Research Grant, Project Code: GPS0012-NSNH-1/2009). The authors also want to thanks to staffs from Core Laboratories (M) especially Mr. Louis King, Mr. Lee, Mr. Manan, Mr. Yazid, Mr. Assan, Mdm. Iza, Miss Yen, Mr. Sam, and Mdm. Anisah for giving me hands to conduct my petrophysic analyses at the company.

REFFERENCES

[1] Folk, R.L., 1980. *Petrology of Sedimentary Rocks*. Hemphill Publishing Company, Austin, Texas.
[2] Hafzan Eva Mansor, Sanudin Tahir, and Baba Musta, 2010. Petrography study on sandstone facies from the Belait Formation, Labuan Island. *Proceeding of Postgraduate Conference, School of Science and Technology, 2010.*
[3] Mazlan Madon, 1996. Sedimentological aspects of the Temburong and Belait Formations, Labuan (offshore west Sabah, Malaysia). *Bulletin of the Geological Society of Malaysia, **41**, 61-84.*
[4] Tiab, D., and Donaldson, E.C., 2004. *Petrophysics: Theory and Practice of Measuring Reservoir Rock and Fluid.* 2nd Edition. Transport Properties, Gulf Professional Publishing, Cis an Imprint of El Sevier.

The Contribution Of Knowledge On Pedagogy, Content Knowledge, Creativity And Innovation Towards Teacher's Self Efficacy In Teaching Economics

Abdul Said Ambotang
SPPS, UMS, Locked Bag No 2073, Kota Kinabalu Sabah
email: said@ums.edu.my

Abstract

The purpose of this study was to identify the direct and indirect contribution of knowledge on pedagogy, content, creativity and innovation towards teacher's self efficacy in teaching Economics. The responses were randomly gathered from two groups of respondents which consisted of 536 students and 107 Economics teachers representing all the schools in Sabah. The study adopted a survey-based non experimental quantitative research design. Two sets of questionnaires were used; Set 1 for students and set 2 for teachers. Items of the questionnaires used in this study were developed by the researcher based on Shulman's PCK theory (1986), Bandura's Theory (1977) and other related teaching theories. Inferential statistics such as t-test, one way ANOVA, Pearson correlation and multiple regression were applied to test the 20 formulated null research hypothesis at a significant level of p <.05. The data were analyzed using the SPSS software version 16 and AMOS version 16. The Pearson correlation (r) result showed that there was a significant positive correlation among the variables involved. Furthermore, the results of the multiple regression test showed that the independent variables had an effect on the focused dependent variable. The results of path analysis indicated that the four independent variables correlated directly and indirectly with the dependent variable for all samples. The findings of multiple regression and path analysis showed that innovation (β=.442, p<.05) and creativity (β=.238, p<.05) demonstrated dominant contributions towards teacher's self efficacy as compared to content knowledge (β=.158, p<.05). In conclusion, the research findings appear to be accurate and supported the conceptual framework used in this study.

INTRODUCTION

Economics is taught in some form in the secondary schools of nations throughout the world. It has been taught as a stand-alone examination subject to prepare
students for various school certificate programmes. It has also been integrated with and taught through personal, social and career education programmes, as well as through other subjects via a process of subject permeation (Jephcote, 2008). Economics teaching at this level of schooling appears to be important for the development of the Economics understanding of students. Although Economics courses are offered in universities, it is argued that the best opportunity for expanding the economic education of the youth of a nation occurs in secondary school (Caropreso and Haggerty, 2009; Abdul Rahim *et al*, 2003).

OBJECTIVE

Generally the main purpose this study to identify the relationship between the selected independent variables and dependent variable in improving the Economics teaching in Sabah.

LITERATURE REVIEW

The reviewed literature was identified through a thorough search for relevant published and unpublished studies that are pertinent to the current research topic. These studies were drawn from psychology, sociology, cultural studies, and other disciplines as well as Economics and education. Methods included conducting computer searches through the electronic online databases (e.g. ABI/INFORM, EBSCO, ERIC, JSTOR, ProQuest) and university catalogues, and examining bibliography and reference sections of the studies to identify further relevant studies.

This literature review provides an overview of the theoretical environment in which this study can be placed. The review will also contribute to the understanding and interpretation of the research questions addressed in this study. In addition, it can be used later during discussion of research findings presented in Chapter Four. Therefore, this section briefly reviews and presents the research, theories and methods concerning teaching and learning in generic education, as well as teaching and learning in Economic education and current classroom practices in teaching and learning of Economics. Specifically, this part is organized into three sections, each providing theoretical insight into the development of the research context. The introduction is the first section. Succeeding sections review topical literature about the models of teaching and related theories of learning, research on teaching and learning, theoretical framework, theory in practice using various approach of learning,

international trends in Economics education, research on teaching and learning of Economics and finally teacher change.

RESEARCH METHODOLOGY

The survey-based non experimental quantitative research design was applied to conduct the research. The data was collected by using two types of questionnaires as an instrument which were delivered to respondents comprising Economics students and teachers from 104 schools all over in Sabah.

RESEARCH FINDINGS

a. Correlation

Based on Table 1, The research result display that there were a strong correlation between the independent variables and the dependent variable. The result showed that the correlation between teacher's self efficacy with knowledge of pedagogy (r= .651), Content Knowledge (r=.718), Creativity (r=.763), Innovation (r=.783).

Table 1: Correlation Between Knowledge of Pedagogy, Content Knowledge. Creativity and Innovation with Teacher Self Efficacy

IV		DV
Knowledge of Pedagogy	Pearson Correlation (2-tailed)	.651** .001
Content Knowledge	Pearson Correlation (2-tailed)	.718** .001
Creativity	Pearson Correlation (2- tailed)	.763** .001
Innovation	Pearson Correlation (2-tailed)	.783** .001

** Sig. level , p< 0.01 (2-tailed)

b. Multiple Regression

Table 2 below, showed the contribution of the independent variable towards teacher's self efficacy in teaching Economic in Sabah.

The result showed that, teacher's innovation (β=.442, p<.05) and creativity (β=.238, p<.05) demonstrated dominant contributions towards teacher's self efficacy as compared to content knowledge (β=.158, p<.05). The results also revealed that teacher' pedagogical knowledge was not a contributing factor towards teacher's self efficacy

Table 2: Multiple Regression of Knowledge of Pedagogy, Content Knowledge. Creativity and Innovation Towards Teacher's Self Efficacy

Variable	*β*	*t*	*p*
Pedagogy Knowledge	-	-	-
Content Knowledge	.159	3.230	.001
Creativity	.238	3.826	.001
Innovation	.442	7.497	.001

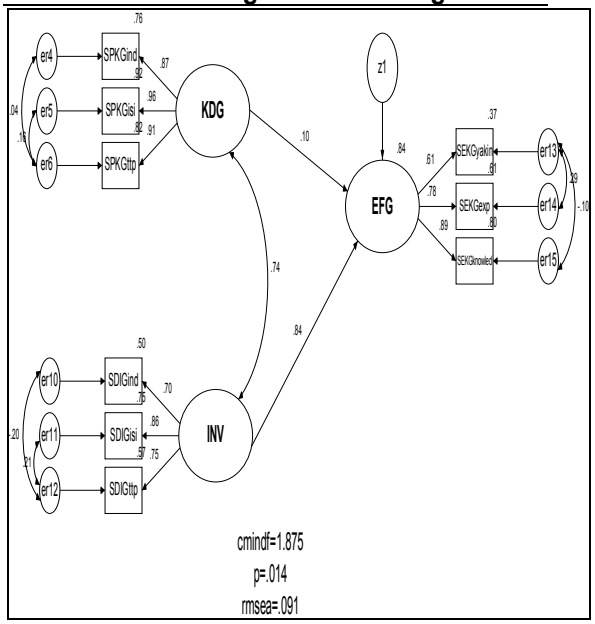
Information :

* p<.05	* p<.05
R² = .635 (Creativity)	R² = .642 (Content)
AR² = .634	AR² = .640
F = 463.775	F = 318.135
P=.001	P = .001
* p<.05	
R² = .613 (Innovation)	
AR² = .612	
F = 846.611	
P = .001	

c. Path Analysis

The Diagram 1, show the most appropriate model for Economics teaching which was derived from the students and teacher's perception those were directly involved in process of Economics teaching and learning.

Diagram 1: Recommendation Fit Model for Economics Teaching in Sabah Using AMOS



The path analysis showed that the model developed as display above contributed 84% (Table: 3) towards teacher's self efficacy. Out of four independent variables used in this study, it was found that only two independents variables contributed significantly towards teacher's self efficacy.

Table 3: Standardized Regression Weights for Fit Model of the Combined Respondents (Teachers and Students)

	P.E	*S.E*	*C.R*	*P*

			P.E	*S.E*	*C.R*	*P*
*EFG	<---	INV	.677	.187	3.627 (>1.96)	*.836
SDIGcont	<---	INV	1.023	.166	6.169 (>1.96)	.704
SEKGexp	<---	EFG	1.370	.202	6.773 (>1.96)	.784
SEKGknow	<---	EFG	1.757	.286	7.317 (>1.96)	.892

P<.05

DISCUSSION

The findings of this study appear to have implications for those involved in professional development programme for classroom teachers and the Minister of Education (MOE) in particular. The findings suggest that significant teacher professional development gaps exist in the Malaysian school system that appear to affect teachers' ability to conduct more an innovative and creative teaching methods to teach Economics in their classroom.

This study sought solutions to some problems in teaching and learning Economics at secondary school in Sabah. It has revealed some evidence to support the effectiveness of innovative and creative approached in teaching and learning Economics in classrooms. It also provided some insights to suggest that an innovative and creative teaching and learning methods can be more relevant and applicable in the countries where the societal cultural values or norms share the principles of an innovative and creative learning.

As has been discussed, the findings of this study suggest that Malaysian students preferred an innovative and creative learning methods over the traditional methods of teaching Economics. Significant differences in the participants' attitudes, behaviors and perceptions were found between the pre and post-intervention in all sources of research data. This suggests that the implementation of an innovative and creative learning at lower secondary school level in Malaysia has a positive impact on teachers' pedagogy and students' learning of Economics.

SUGGESTIONS

The findings of the present study provided a unique description of implementation of an innovative and creative learning model that was specific to the participants of some selected schools in Malaysian specifically in Sabah. As has been outlined, this study provided a justification for student centered teaching and a case for an innovative and creative learning as an alternative method of teaching Economics. Although the outcome of this study demonstrated some insights for effective teaching and learning of Economics at secondary school level more research is needed to determine how students of various abilities and developmental levels experience different teaching situations. Given the nature of students' motivation and interest to engage in small group learning, further research may be needed to examine a number of meaningful questions by comparing innovative and creative learning with other methods of teaching Economics at this level. This may provide some valuable insights into teaching and learning processes. Additional research may be required at the secondary school level in Sabah or in Peninsular Malaysia as well.

As has been mentioned the previous studies in an innovative and creative learning were conducted in western countries, but the findings of the present study are based on a group of students representing all the school in Sabah. This adds a new dimension to the existing literature and should also interest those researchers and practitioners who advocate an innovative and creative learning as a preference for students of colour in western multicultural societies.

The implications of a study such as this for the teaching and learning of Economics must be assessed in context. Since students in Sabah live in a society where tradition asserts that the group is more important than individuals; teachers, administrators, practitioners, policymakers, and teacher educators in Sabah will have to acknowledge the importance of culturally appropriate teaching pedagogies along with the competitive and individualistic learning practices that are believed to be imported as part of the school curriculum package from overseas.

CONCLUSION

Although an innovative and creative learning methods appear to have a strong record of success in increasing student motivation to learn (Johnson and Johnson, 2007), providing positive relationships among students (Slavin, 2005) and enhancing higher academic achievement (Brown and Thomson, 2005; Johnson and Johnson, 2005; 2001; Johnson, Johnson and Holubec, 2004; Kagan, 2005; Sharan and Sharan, 2006; Slavin, 2003), it has been argued that training and systematic instruction in various techniques as well as consistent practice and effort (Brown and Thomson, 2005) are the keys of success or failure in an innovative and creative learning because the success of an innovative and creative learning strategies is not automatically guaranteed (Johnson and Johnson, 2007; Kagan, 2002; Slavin, 2003).

A meaningful link between home and school experiences appears necessary for effective classroom learning, because societal culture is believed to have a potential impact on what takes place in the classroom. The participants' preference for the an innovative and creative learning method to learn Economics at secondary schools in Sabah may suggest the nature of this link between their

cultural roots, and the norms and values of an innovative and creative learning.

REFERENCES

[1] Abdul Rahim *et al*, (2003). *Ilmu Pendidikan untuk KPLI*. Kuala Lumpur, Utusan Publication Sdn Bhd.

[2] Brown, D., and Thomson, C. (2005). *Innovative learning in New Zealand schools*. Palmerston North: Dunmore Press

[3] Caropreso, E., and Haggerty, M. 2009. Teaching Economics: An Innovative Model. *College Teaching,* **48**(2): 69-74.

[4] Jephcote M. 2008. Economics in the school curriculum: Its origins, and reflections on the workings of a subject community. *Teaching Business and Economics,* **8**(1): 13-20.

[5] Johnson, D. W., and Johnson, R. T. (2007). *Multicultural education and human relations: Valuing diversity*. Boston: Allyn and Bacon.

[6] Johnson, D. W., and Johnson, R. T. (2005). *Teaching students to be peacemakers* (3 ed.). Edina, MN: Interaction Book Company.

[7] Johnson, D. W., and Johnson, R. T. (2002). implementing Innovative learning. *Contemporary Education,* **63**(3), 173-180.

[8] Kagan,, S. (2002). *Innovative learning: Resources for teachers*. Capistrano, California: San Juan.

[9] Sharan, S., and Sharan, Y. (2006). *Small-group teaching*. Englewood Cliffs, NJ: Educational Technology Publications

[10] Sharan, Y., and Sharan, S. (2002). *Expanding innovative learning through group investigation*. New York: Teachers College Press.

[11] Slavin, R. E. (2005). Synthesis of research on innovative learning. *EducationalLeadership,* **48**(5), 71-82.

[12] Slavin, R. E. (2003). *Cooperative learning: Theory, research, and practice*.Needham Heights. MA: Allyn and Bacon.

Security issues of Relay-Based IEEE 802.16m Networks

A. S. Khan, N. Fisal, S. K. S. Yusof, S. H. S. Ariffin, N. N. Maarof, M. Abbas
UTM-MIMOS Center of Excellence in Telecommunication Technology,
Faculty of Electrical Engineering, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia.
Wireless Communication Cluster, MIMOS Berhad, Technology Park Malaysia

Abstract
A WiMAX network usually operates in a highly dynamic and open environment therefore it is known to be more vulnerable to security holes. In this paper, we discussed some security issues and propose a new fully trustworthy authentication and key management approach for Vulnerabilities in Relay-Based IEEE 802.16m Networks. The propose scheme uses distributed authentication and key management approach for hop-by-hop authentication. We uses distributed non-transparent, decode and forward multi-hop relays that is responsible for localized authentication. Both analysis and performance evaluation shows that less complex distributed and trustworthy scheme can significantly increase the throughput, and reduce the security holes as well as communication overheads

Keywords
Wimax Security, Mesh Network, Key Management, Denial of service, replay attacks

INTRODUCTION

Wimax has security vulnerabilities which, if it were possible to create a significant disruption in communication with little effort from the attacker, could threaten its wide spread deployment. During the registration process, an RS can be configured to operate in distributed security mode based on its capability called NRS. Since message 1 is optional and informative we begin with the security analysis from the message II discussed by author [1][2], as this message is plain text but eavesdropping is not a problem since the information is almost public and is preferred to be sent in plain text to facilitate authentication, however, Non-transparent Relay (NRS) may face a replay attack from an adversary who intercepts and saves the authentication messages sent by a legitimate NRS previously, although an adversary eavesdropping the message cannot derive the AK from message, because it doesn't have the corresponding private key the adversary still can replay message II multiple times and then either exhaust NRS capabilities or force NRS to deny the SS who owns that certificates. The reason is that if NRS sets a timeout value which makes NRS reject Auth REQ from the same MS in a certain period , the legitimate request from the victim MS will be ignored. Then denial of service attack occurs to victim MS , however the ultimate solution for these types of attacks are the introduction of signatures at the end of the messages and digital signature can be automatically time-stamped which basically provides the authentication and non-repudation of this message. The design of digital signature system may be flawed or vulnerable to some specific attacks like collision attacks against X.509 public-key certificates. Cryptographically weak pseudo random bit generator. Adversaries may attempt for total break, universal forgery, selective forgery or existential forgery.

The rest of the paper is organized as follow, after related work, section 3 gives the overview of generals attacks on network, then section 4 discuss centralized and distributed authentication controls, section 5, describe the self-organize system model, section 6 gives the analysis of proposed scheme which is followed by conclusion and future work.

RELATED WORKS

In 2006, the IEEE 802.16 working group (WG) approved a project Authorization Request (PAR) focused on the Relay Tasks Group (TG). Relay stations concept as discussed in [13][14] and [3] introducing four types of RSs from the perceptive of physical and Mac layer. After successful comparison, the main focus is on the non-transparent RS operating in distributed scheduling and security mode [3], due to its throughput improvement, coverage extension and high bandwidth efficiency nature. As the matter of fact, due to lack of physical boundaries, the whole relay-based mesh infrastructure in expose to security holes. there are some papers they purely works on key managements specially Sen Xu and Manton Mathews who published a series of work like [1] and [8] on security issues on the standard as well as on Privacy key Management protocols (PKM). Karen Scarfore with his team come up with a special publication on Guide to security for Wimax technologies(Draft) which was the recommendations of the national institute of standards and technology(NIST). Taeshik Shon, Wook Choi [9] discussed about the Analysis of Mobile WiMAX Security, Vulnerabilities and Solutions. Y.Lee and H.K.Lee in their paper [3] gives more focus on hybrid authentication scheme and key distribution for MMR in IEEE 802.16j.

The authors [10] and [11] review the standard and analyzed its security in many aspects, such as vulnerabilities in authentication and key management protocols and failure in data encryption. Very sparse work is done specially on DoS and replay attacks such as [12][13][14], However none of these above publications cover the DoS and replay attacks issues

and proposed low-complex and high throughput scheme for the trustworthiness, authentication and key Relay-based WiMAX in a detailed way to open the new way of thinking for the researchers in the field of security in WiMAX.

General Attacks on Relay-Based WiMAX Network

Before we start to elaborate our operation of the self-organized algorithm, we would like to introduce some typical attacks on authentication and key management protocols. Message replay attack is one of the most common attacks on authentication and authenticated key establishment protocols [9]. In a replay attack, the attacker captures a transmitted message and resends it after certain amount of time, for example, MR-BS/NRS may face a replay attack from an adversary who intercepts and saves the authentication messages sent by legitimate NRS/MS previously [11]. Dos attacks on the BS/NRS could happen during the PKMv2 authentication because of the heavy public key computational load. Here, we assume that the attacker is external to the network and is able to analyze the unencrypted parts of the management traffic and observes the timing, size, and source of traffic. Attacker can prevent or hinder communication with little effort by disrupting certain important packets. All messages communicated prior to secure key exchange between BS and NRS/MS/RS are not authenticated. Man-in-the Middle attack is another classic attack and is generally applicable in a communication protocol where mutual authenticationis absence [3].

Proposed Trustworthy Authentication and Key Management Scheme

Authentication Procedures of NRS1 with MR-BS

In our proposed approach, NRS1 received the AUTH-REQ (NRS2) and send it to MR-BS during the refreshing of AK message because these authentications are delay tolerance. After MR-BS validates NRS2 it send AK2 and SAID list to NRS1 in its AUTH-REP message, here NRS1 send AK21 and SAIDLIST encrypted with the NRS2's public key. At this stage, NRS2 start sending reauthorization request directly to NRS1 and NRS1 is responsible for sending all the refresh keys, as we already mentioned that these relays are non- transparent decode and forward working in distributing security mode [3]. So can generate AUTH-REP on the behalf of MR-BS but cannot authenticate its real validity as its does not contains the vendors digital certificate database. Thus

NRS2's AK and TEK state machines start sending refreshing of the keys materials request to NRS1 and NRS1 response with new keys on behalf of MR-BS as shown in figure 4. If NRS1 fails to re-authenticate before the expiration of its current AK, the MR-BS will hold no active AKs for NRS1 and will consider NRS1 unauthorized. A MR-BS will remove from its keying tables all TEKs associated with NRS1 [standard]. The beauty of our novelty is all NRSs maintains the tables we called this table knowledge shared table (KST) of recently exchanged AK with its neighbors and if NRS2 fails to re-authenticate before the expiration of its current AK, NRS1 will wait until it send AUTH-REQ message, NRS1 will check its KST, if it found then validates its authenticity locally rather than sending again to MR-BS and wait for the response and compute the keys and send to NRS2, the advantage is the communication cost and less complexity

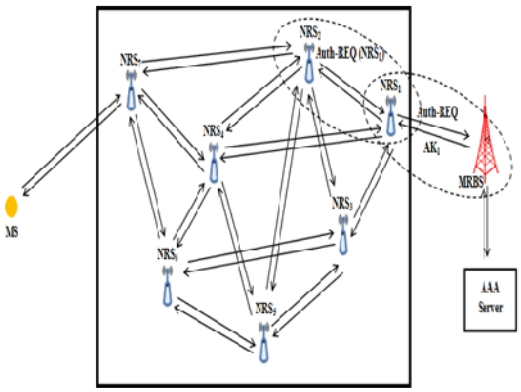


Figure 1: Authentication of NRS1 with MRBS

Authentication Procedures of NRSn with NRS1/MR-BS

NRS3 send its AUTH-REQ message to MR-BS, the request will move through authenticated relays as only authenticated relays start sending UL-MAP messages. All the intermediate NRS will save the copy of the request in its KST, as this request contains its most confidential data. After successful validation MR-BS send the AUTH-REP to neighboring NRS1, NRS1 knows that this message is not from NRS2 because NRS1 have all the updated KST so it will again encrypt this message with public key of NRS2 and send back in AUTH-REP message and NRS2 also save the SAIDLIST information in its KST and send back in AUTH-REP to NRS3 with its own generated AK23 on behalf of MR-BS as shown in figure 5. As all NRS consider their serving NRS as MR-BS [3].

Localized and Distributed Key Management in Relay-Based WiMAX Mesh Network

We assume that all the NRS are authenticated and maintains theirs KST. Inside the KST, we have two portions, one is updated and other is non-updated stacks, all the active and valid AK, TEK and SAIDLIST are resides inside the updated one, and all Figure 3: All NRSs are get authenticated

the expired and revoked keys are inside that non-updated stack.

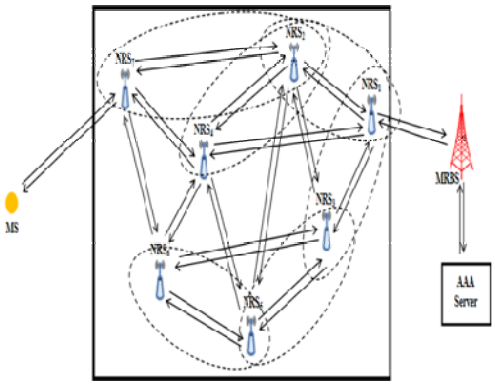


Figure 2: Localized authentication amongst NRS

If any new NRS want to join the network, the serving NRS first look at in its KST in updated stack, if it cannot find the required information, it will move to non-updated stack, if still it cannot find inside non-updated stack, the serving NRS will send the AUTH-REQ to the MR-BS through other NRS and all other procedures are same. And if incase it found in either of the stack, it validate its authenticity and send SAIDLIST and AK in AUTH-REP message and send one copy to the MR-BS for its own KST. MR-BS validates its authenticity, if its valid then it will save in its KST else send AUTH-REJECT message in AUTH-REP.now the entire network is doing distributed authentication.

Analysis of Our Proposed Approach

Evaluation against Denial of Service

Denial of service is one of the major attacks in wireless networks especially in Wimax. Let's suppose, any NRSk which is basically attacker, sends AUTH-REQ message, which is always a plain text but eavesdropping is not a problem since the information is almost public and is preferred to be send in plaintext to facilitate authentication. MR-BS may face replay attack from the adversary who intercepts and saves the message, here, an adversary eavesdropping the message cannot derive the AK as its doesn't have corresponding private key, this adversary still can replay AUTH-REQ message

Evaluation against Reply Attack

As in section 3, we have described briefly about the replay attack and our related work not only focused on the research trends but also shows the weaknesses. Our self-organized scheme can handle easily with replay attack, let's suppose, any attacker pretend NRS and send AUTH-REQ message, this AUTH-REQ message will be validated by different NRS repositories, and if cannot found then we consider attacker as impersonates, and secondly we use nonce version of authentication protocol so with all together, its very difficult for the attacker to do replay attack, and the beauty of our scheme is after several messages exchanged within the network, the network become more secure and truth worthy

CONCLUSION AND FUTURE WORK

In this paper, we addressed a novel, hop-by-hop authentication and key management scheme in non-transparent Relay-based WiMAX mesh network. If any NRS cannot refresh its key within particular given time due to uncertain circumstances, according to standard, it have to re-authenticate with MR-BS, but in our scheme, it will send the request to NRS, NRS will look into its local repositories, if found then send AK/SAID by itself, else send the request to other neighbor NRS, if all the NRSs could not manage to find requesting NRS security particulars, it will send the AUTH-REQ to MR-BS for authentication and validation and consider it as a new NRS/MS.

ACKNOWLEDGEMENT

The author would like to thanks to all WiMAX research group for their constant help in this topic. This work is fully funded By Ministry of Higher Education under Malaysian Technical Cooperation Programme (MTCP) award and partially by MIMOS BERHAD.

REFERENCES

[16] S. Xu and Huang. Attack on PKM protocols of IEEE 802.16 and its later version. In international Symposium on wireless Communication System (ISWCS), 2006.

[17] M. Abadi and R. Needham, Prudent Engineering Practice for Cryptographic Protocols", IEEE transactions on Software Engineering, 1995.

[18] Mosato Okuda, Chenxi Zhu and Dorin Viorel, Multihop Relay Extension for Wimax Networks-Overview and Benefits of IEEE 802.16j Standard, FUJITSU Sci.Tech.J., 44,3, p.292-302 (July 2008)

[19] Adnan Shahid Khan, Prof.Dr.Norsheila Fisal, Sazzad Hossain, "Man-in-the-Middle Attack and possible solutions on Wimax 802.16j".In proceedings of International Conference on Recent and Emerging Advanced Technologies in Engineering (iCREATE 2009). Pan pacific KL international airport Hotel Malaysia, 22-24 November 2009.

[20] Y.Lee, H.K.Lee, G.Y.Lee, H.J.Kim and C.K.Leong, "Design of Hybrid Authentication Scheme and Key Distribution for Mobile Multi-Hop Relay in IEEE 802.16j", EATIS'09, June 3-5, Prague,CZ, 2009.

[21] Adnan Shahid Khan, Prof.Dr.Norsheila Fisal, Abdelhamid. "Security Sublayer : A Required

Evolution of Wireless Security IEEE 802.16j".In proceedings of IEEE international Conference on Antenna Propagation and System (INAS 2009) Grand paragon Hotel, Johor Bahru, 3-5 December 2009

[22] Huang C, Chang J. Responding to security issues in Wimax networks. IT Professional 2008; 10(5):15-21

[23] S. Adibi, G. B. Agnew,T. Tofigh, End-to-End (E2E) Security Approach in WiMAX: Security Technical Overview for Corporate *Multimedia Applications,* 747-758, Handbook of Research on Wireless Security (2 Volumes) Edited By: Yan Zhang, Jun Zheng, Miao Ma, 2008.

[24] Sen Xu, Manton Matthews and Chin-Tser Huang. Security Issues in Privacy and Key Management Protocols of IEEE 802.16. In ACM SE'06. Florida USA. March 2006

[25] Taeshik Shon, Wook Choi: An Analysis of Mobile WiMAX Security: Vulnerabilities and Solutions, First InternationalConference, NBiS 2007, LNCS, Vol. 4650, pp. 88-97, 2007.

[26] Adnan Shahid Khan et. al. "Efficient Distributed Authentication Key Scheme for Multi-hop Relay In IEEE 802.16j Network", International Journal of Engineering Science and Technology (IJEST), Vol. 2(6), 2010, 2192-2199

Antimicrobial Properties of Banana (*Musa Balbisiana* cv Saba) Influorescence on Foodborne Pathogens

Tin Hoe Seng[1,*], Chye Fook Yee[1] Mohd Ismail Abdullah and Charles S. Vairappan[2]
[1] School of Food Science and Nutrition, Universiti Malaysia Sabah, Jalan UMS, 8840 Kota Kinabalu, Sabah.
[2] Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah, Jalan UMS, 8840 Kota Kinabalu, Sabah.
*mhstin@gmail.com

Abstract
The purpose of this study was to determine the antimicrobial activity of buds from pisang saba (Musa balbisiana BBB) inflorescence. The Minimum Inhibitory Concentration (MIC) value of methanolic water partition against S. aureus and B. cereus were 8 mg/ml and 12 mg/ml, respectively while 20 mg/ml and 25 mg/ml is needed to pose MIC against L. monocytogenes and V. parahaemolyticus. In vitro study using food components found that increment of 1% of protein and fat content significantly ($p<0.05$) reduced the efficacy of antibacterial activity of the extract. In food model using chicken breast kept at 4°C, 6% methanolic water partition showed stronger inhibitory activity than sodium benzoate (5%) if stored at -18°C. Liquid chromatography mass spectrometry analysis indicates epigallocatechin and their derivatives are the major compounds in the extract while others are tryptophan, vanillic acid glycoside as well as 4 unidentified nitrogen containing compounds. Further study on toxicology should be carried out to determine the properties of the extract and responsible compounds shall be purified.

Keywords
banana inflorescences, methanolic, partition, antimicrobial, LC-ESI-MS/MS.

INTRODUCTION

Food safety is the world concern especially with the increasing popularity of ready-to-eat foods. Thus, to reduce health hazards and economical losses due to foodborne microorganism, natural antimicrobial is suggested as an effective way (Dorman & Deans, 2000). Natural antioxidant compounds are also required to reduce food deterioarion and health promotion. Recently, there is a growing interest to cooperate plant derivatives into food, as natural source, to substitute synthetic antimicrobial and antioxidant compounds.

Plant-derived bioactive compounds possessed antimicrobial activity against wide range of food spoilage and pathogenic bacteria (Holley & Patel, 2005). *Musa* spp. served important crops which are widely planted and 80-90% of the tree would become waste and may cause serious environmental problems. However, commercial values of banana/plantain by products are considered low. Since banana inflorescence used as food and also remedy to heal cardiovascular diseases, diabetes, high blood pressure, fever and cough. It may consist of bioactive compounds that could benefits human. The purpose of this study is to determine the antimicrobial activity of extracts from banana.

MATERIALS AND METHODS

The byproducts of *Musa baibisiana* cv Saba obtained from local plantations were screened for antimicrobial activity. The inflorescences were separated into bract and buds before dried at 50ºC until 10.0%+0.5 of moisture level and ground into powder. *Musa balbisiana* cv. Saba was selected for individually extraction using hexane, petroleum ether, chloroform, ethyl acetate, isopropanol, acetone, ethanol, methanol, and water by direct infusion. The antimicrobial activity of these extracts were determined using well diffusion against gram-positive bacteria (*Staphylococcus aureus, Bacillus cereus, Listeria monocytogenes*), gram-negative bacteria (*Salmonella typhimurium, Escherichia coli O157:H7, Enterobacter sakazakii, Yersinia enterocolitica and Vibrio parahaemolyticus*) and fungus (*Candida albicans*).

Optimized extract (100% methanol, 35ºC for 8 hours) was successively partitioned with chloroform, ethyl acetate and butanol against water and the fractions were tested for antibacterial activity. Selected bioactive water partitions were subjected to SPE (Strata X, Phenomenex) purification prior to LC/MS determination. The third fraction (elution using methanol: acetonitrile 1:1 yield only secondary metabolites) that showed the strongest antibacterial activity was collected and subjected for compounds identification using Waters UPLC-Synapt MS. Meanwhile, the selected water partition was evaluated for their minimum inhibitory concentrations based on the kinetic time kill assay against the selected bacterial pathogens (*Staphylococcus aureus*, *Bacillus cereus*, *Listeria monocytogenes* and *Vibrio parahaemolyticu*) within 36hrs. Influence of food components on bioactive water extracts were studied using TSB as based and fortified using different compotent as below: starch (0%, 1%, 10% and 30% (w/v) water soluble starch, Sigma-Aldrich); protein (0%, 1% and 10% (w/v) meat extract, Sigma-Aldrich); oil (0%, 1%, 10% and 30% (v/v) palm oil); sodium chloride (0%, 0.5%, 2% and 8% (w/v) NaCl, Merck); pH (4,5,6,7 and 8) and temperature (7, 28 and 35°C). It was also evaluated for the efficacy in food model system using chicken breast, dipping with

methanolic water partition (3% and 6%) and sodium benzoate (5%) *on Listeria monocytogenes* with the storage temperature of 4ºC and -18ºC. All t he test were done in triplicate and analysis of variance and was performed using the SPSS v.16 for Windows with significant level of ($p< 0.05$).

RESULTS AND FINDINGS

Extraction parameters optimized from the generated response surface plots yielding the combination of 100% methanol by direct solvent infusion at 35ºC for 8 hours with constant shaking. Four partitions (chloroform, ethyl acetate, butanol and water) were further screening on antimicrobial activity and water partition shown highest inhibition diameter of 9.67 – 16.00mm against *S. aureus*, *B. cereus*, *L. monocytogenes* and *V. parahaemolyticus* which is comparable to kanamycin (13.50 – 21.15mm), followed by butanol partition (6.17 – 9.50mm) as observed in **Table 1**.

Table 1. Antimicrobial activity of the inflorescence of *Musa balbisiana* cv. Saba by well diffusion assay

	Diameter of Inhibition Zone (mm)			
	SA	BC	LM	VP
$CHCl_3$	-	-	-	-
EtoAC	-	-	-	-
BuOH	8.67	9.50	6.17	-
H_2O	15.17	16.00	9.67	10.00
Kanamycin	17.55	21..15	17.55	13.50
Gentamycin	16.12	16.62	15.75	18.65

$CHCl_3$ Fr.: Chloroform fraction, EtoAc Fr.:Ethyl Acetate fraction, BuOH Fr.: Butanol fraction, H_2O: Water
- : no activity observed

Water partition displayed the MIC and MBC against *B. cereus* with 8 mg/mland 14mg/ml, respectively in Table 2. However, it took concentration of 3mg/ml to achieve MBC for *L. monocytogenes* while only 25mg.ml against *V. paraharmolyticus*.

Table 2. MIC and MBC of the water partition inflorescence of *Musa balbisiana* cv. Saba by broth dilution assay.

	MIC (mg/ml)	MBC (mg/ml)
S. aureus	10	16
B. cereus	8	14
L. monocytogenes	25	30
V. parahaemolyticus	20	25

In experiment where effect of food compoent against water extracts efficacy towards *L. monocytogenes* and *S. aureus* unveil that that increment of 1% of protein and fat content significantly ($p<0.05$) reduced the efficacy of antibacterial activity of the extract. Meanwhile, other component (starch, NaCl, pH and temperature) do not contribute to significant ($p<0.05$) antibacterial efficacy of water extract in TSB.

In the food model system using chicken breast stored at -18°C, the poultry treated with 6% water fraction showed similar effect with 5% sodium benzoate on *L. monocytogenes* until day 7 until a streamline reduction of close to 0.5 log cfu/g reduction Figure 1). Meanwhile, no increment of *L. monocytogenes* counts observed in chicken breast meat treated with 3% water partition throughout the study. Treatment of 6% of water partition showed similar potential with the storage of 4°C with no increment of *L. monocytogenes* counts as 5% sodium benzoate (Figure 2). The treatment of chicken breast with dipping of 6% water partition showed similar inhibition as compared to sodium benzoate throughout the week with continuous reduction at -18°C and bacteriostatic activity at 4°C. The microbiological count observed on treated chicken meat at all the test condition remain static until the end of study (7 days) except at the storage of 4°C for *L. monocytogenes.*

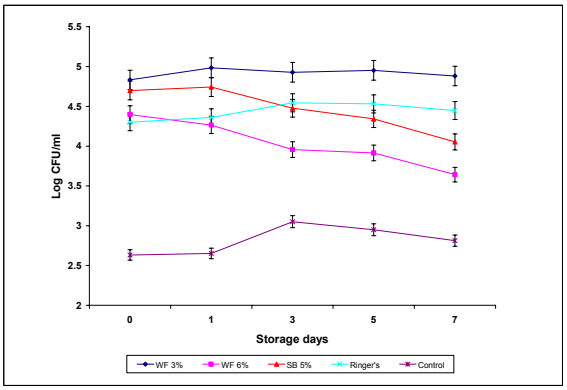


Figure 1. Growth curve of *Listeria monocytogenes* in chicken breast meat treated with water fraction 3% v/v (WF 3%), water fraction 6% v/v (WF 6%), sodium benzoate 5% v/v (SB 5%), and sterile Ringer's solution (Ringer's) stored at -18ºC. Data represent mean values ± standard deviation.

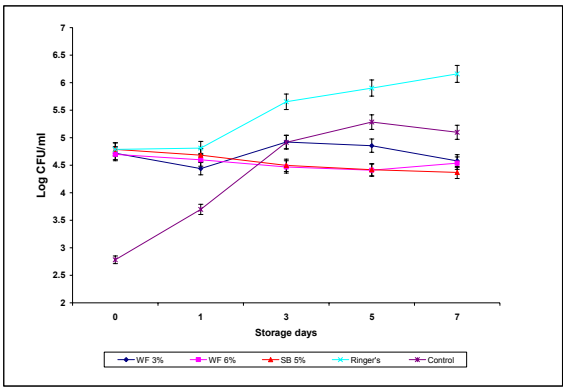


Figure2. Growth curve of *Listeria monocytogenes* in chicken breast meat treated with water fraction 3% v/v (WF 3%), water fraction 6% v/v (WF 6%), sodium benzoate 5% v/v (SB 5%), and sterile Ringer's solution (Ringer's) stored at 4ºC. Data represent mean values ± standard deviation.

After fractionation using SPE, the chromatogram from UPLC/MS and UPLC/MS/MS showed in figure 3. In this

experiment, tandem ms spectral data revealed that the potential antimicrobial compounds obtained from the fraction were epigallocatechin and its derivatives, benzoic acid derivative, xanthone derivative and 4 tentatively nitrogen containing compounds remain unknown as shown in Figure 3. The loading of water partition on the SPE, and wash out using 5% methanol will successively washout primary metabolites especially sugar and protein/ peptide while with the subsequent elution of methanol: acetonitrile (1:1) will then elute the secondary metabolites.

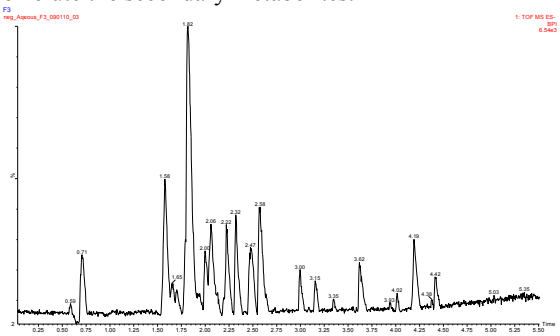


Figure 3. Chromatogram of secondary metabolites purified from BWF through SPE Strata-X of *Musa balbisiana cv. Saba.*

Table 3. Tentative compounds identified from BWF of *Musa balbisiana cv. Saba*

Peak No.	Retention time (min)	Detected Mass (M-H)- Da	Identitied compounds
1	0.71	191.0703	iso-citric acid
2	1.58	609.1220	EGC dimer
3	1.82	609.1220	EGC dimer
4	2.00	305.0700	EGC
5	2.06	913.1849	EGCtrimer
6	2.22	593.1263	EGC dimer
7	2.32	913.1848	EGC trimer
8	2.47	203.0956	L-tryptopan
9	2.58	329.0909	vanillic acid glucoside
10	3.00	305.0702	EGC
11	3.15	443.1913	unknown
12	3.35	323.1021	unknown
13	3.62	391.1660	unknown
14	4.19	355.1667	unknown

- EGC : epigallocatechin

CONCLUSION

As a summary, water partition showed highest inhibitory activity against bacteria tested. In food model using chicken breast kept at 4°C, 6% methanolic water partition showed stronger inhibitory activity than sodium benzoate (5%) if stored at -18°C and epigallocatechin and its derivatived found as major components in BWF. As conclusion, banana bioactive components serve as potential bio-preservative candidates for fresh meat and further toxicological study based on animal and design of proper hurdle should be determined.

ACKNOWLEDGMENTS

The author thank you to MOSTI for providing

- scholarship under HDC, MOSTI, National Science Fellowship (NSF) (Ref No.: M/0001/02/2007/BIO),
- financial support on the project (Science Fund, No. 02-01-10- SF0061) and,

Department of Agriculture for species identification,

REFERENCES

[1]. Dorman, H.J.D. & Deans, S.G. Antimicrobial agents from plants: antibacterial activity of plant volatiles oils. *Journal of Applied Microbiology*. **88**(2000).: 308-316.

[2] Holley, R.A. & Patel, D. Improvement in shelf-life and safety of perishable foods by plant essential oils and smoke antimicrobials. *Food Microbiology*. **22**(2005.: 273-292).

Stacked Aquaponic as a High Yield Recirculating System

Neoh Seong Lee[1,2,*], Dr. Mohamadu Boyie Jalloh[1] and Prof. Dr. Saleem Mustafa[2]
[1]School of Sustainable Agriculture, Universiti Malaysia Sabah.
[2] Borneo Marine Research Institute, Universiti Malaysia Sabah.
*neohseonglee2004@yahoo.com

Abstract
Aquaponic presents at least two major problems that need to be addressed in order for it to gain wider adoption. 1) the high cost (both operation and capital); 2)crop production reliability and consistency. This research attempts to solve the mentioned problems by proposing a solution package called 'Stacked Aquaponic' (STA). STA proposes a planting structure that capitalizes on the vertical farm area and thus reducing land cost and footprint 30%. It also operates differently than normal aquaponic in the aspect of recirculation and nutrient management. STA advocates returning to the inviolable principle of aquaculture and hydroponic by severing the continuously recirculating loop, allowing complete water quality and nutrient control in both animal and plant production units. This greatly increases production reliability and consistency.

Keywords
Aquaponic; vertical; aquaculture effluent; stacked; hydroponic

INTRODUCTION

Aquaponic is a form of integrated farming that has undergone much transformation in the last 20 years. The word aquaponic comes from the term 'aquaculture' and 'hydroponic'. Hydroponic is the practice of growing plants without using soil as a medium, instead the substituted non-soil medium acts only to support the plants with its roots suspended in nutrient enriched water. This nutrient enriched water is typically made from water soluble inorganic fertilizers. Aquaculture effluent has very similar nutrient composition to the typical inorganic hydroponic fertilizer, though not as balanced. Many attempts have been made to use this very abundant resource to generate a cash crop. The notion that it is simply a matter of substituting the typical hydroponic solution with the aquaculture effluent has proven to be the fundamental mistake of anyone attempting to venture into aquaponic. The management of two very different crop linked together in a real world farm scenario poses many complications. The desire to maintain a suitable nutrient level without any inorganic nutrient addition has led the farmer to compromise the water quality in the aquaculture operation by allowing nutrient build up. Aquaculture specialist usually squirm at such compromise, as the fundamental principle of aquaculture is always to keep all nutrient level as low as possible. Undoubtedly, such delicate balance can be achieved and has been achieved in many aquaponic operations. Yet, it is a delicate balance. Many times the tilting of this balance has led to the consequence of compromising the salability of both crops. This is the main reason why to date aquaponic is not commonly adopted.

The other reason for the unenthusiastic acceptance of aquaponic is very much similar to many other 'high-tech' farming operations, it is too 'high-tech'. The high initial investment and complexity of operating such system is a strong deterrent to anyone pondering venture into aquaponic.

This research is an attempt to analyze and propose a solution package to these two problems. The proposed solution package is called 'Stacked Aquaponic'. Firstly, we address the cost issue by proposing a planting structure that utilizes the vertical space of a farm area. Our model and prototype has shown a 30% reduction in land cost and footprint when compared to the typical aquaponic system as a result of this planting structure.

Secondly we address the nutrient management issue and operation complexity by proposing a new operation mode. In essence, this new operation mode returns to the basic inviolable principle of hydroponic and aquaculture. That is, giving the aquaculture crop the cleanest possible water and the plant, maximum needed nutrient. In this mode, we break the continuous recirculating loop that is the hallmark of aquaponic. By severing the continuous water flow between plant and fish it allows significant cost savings in trace element supplementation and also full control of two crops. No crop is held hostage by the other. Next, the recirculating aquaculture system (RAS) is returned to its fundamental operation, which is good filtration and 5-10% daily water change. The effluent from the daily discharge is then funneled to a super intensive kangkung scrubber. This is similar to a passive hydroponic system but the difference is that it was designed on the principle of maximum root area-minimum water volume. This maximized root area per volume water scrubber main function is to scrub off most of the nutrient in the water. Because of this super intensive root-water ratio, we reduce the water

retention time and therefore minimizing the area dedicated to scrubbing. The kangkung functions only as a scrubber, the salability of it is secondary. The ultimate purpose of this scrubbing is to prepare the water for hydroponic use. By determining the optimum water retention time for the scrubber, we take out the need of water quality monitoring before nutrient dosing. We can now regard this almost nutrient barren water as new water with no fear of overdosing and no need of water quality testing. This is especially helpful to the typical farmer who is less inclined to constantly perform water test.

Our next step is to dose the water with inorganic nutrient, similar to those of typical hydroponic. In this respect we digress from the pure aquaponic which view inorganic nutrient addition as a violation of aquaponic principles. However, we beg to differ as almost all aquaponic operation needs to be dosed with trace element. And this new proposed operation mode in actual fact is still well within the founding principle of aquaponic, that is to reuse aquaculture effluent to generate a cash crop.

OBJECTIVES

1. To determine the growth performance (biomass gain) of an indicator crop in the stacked planting structure .
2. To determine the efficiency and effectiveness of the super intensive kangkung scrubber in removing nutrient.
3. To determine the growth performance (growth rate and biomass gain) of an indicator crop that is grown in aquaculture effluent that is scrubbed and fully nutrient supplemented compared to unscrubbed and unsupplemented (except for trace elements) aquaculture effluent.

METHODOLOGY

Each Stacked plant sub-unit consists of white UPVC pipes each with a length of 3m. The spacing of the pipes and the configuration of the holes are the same as the conventional aquaponic plant sub-unit except for the layout of the pipes. They are supported by specially constructed stands that support the lowest pipe at 60cm from the ground and the highest pipe at 150cm from the ground. The design is in such a way that an average Asian of about 156cm is able to easily reach the highest plant. The pipes have a slope of 5^o. Water goes in to one end and exits the opposite end of the pipe. This Stacked plant sub-unit can be connected to either a hydroponic or aquaponic system. In this paper, it is connected to aquaponic system.

The conventional plant unit (figure 2)

Each Conventional plant sub-unit consists of seven white UPVC pipes each with a length of 3m. The pipes are spaced apart with a 3" gap. They are all supported by stands, elevating them to a height of 1m. This height is chosen as it is a comfortable height for the farmer to work on the system. From the inlet of the pipe to the outlet, the pipe has a slope of 5^o. Other than the layout of the pipes, (which are laid in a single plane, not stacked), the conventional plant unit is identical to the Stacked unit.

Figure 1. Stacked Plant Unit (cross section)

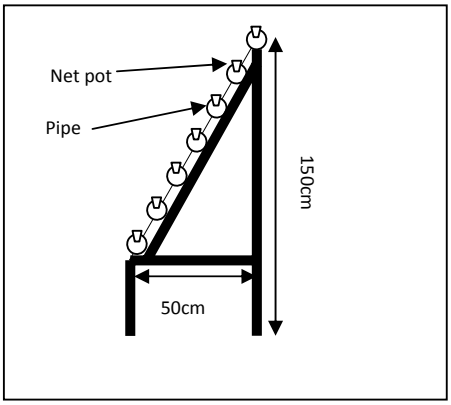
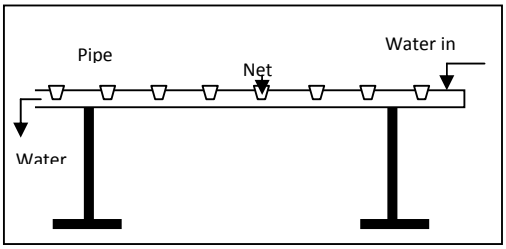


Figure 2. Conventional Plant Unit (cross section)



Effect of Stacked design on plant biomass gain

This experiment was designed to compare the average individual plant biomass yield of two different planting structure, 'Stacked' and 'Conventional' planting unit. The emphasis is to determine if there is any difference in growth of plant caused by the structure of the system itself. The experiment layout consists of three 'Stacked' planting structure and three 'Conventional' planting structure linked to the same body of fish tanks and filters. This is to ensure that the difference in growth is not influenced by differences in nutrient contents.

The indicator plant used in this experiment is the Kang Kung. The plants are germinated off site in individual net pots. The medium used to fill the net pot is a commercial product called 'Jiffy'. Three Kang Kung seeds are placed in each net pot and allowed to grow for two weeks in a germination box filled with 1cm depth of water. This is to ensure the plants develop healthy roots before being transferred to the aquaponic systems.

After 2 weeks, the plants are randomly distributed to the six plant sub-units. Each plant sub-units will have 25 plants. The plants will remain in the system for 2 weeks. During this period of time, the plants receive their nutrients from the fish culture water only. Except for the addition of a missing trace element, there is no other nutrient addition.

The amount of average solar radiation received per day will then be used in an equation to model the difference in solar energy received by the Stacked plant unit and the control. The plants are harvested at 8am in the morning. During harvest, every plant from all plant sub-units are measured for their fresh weight (excluding roots). The plants are then dried in the oven at 90°C overnight and measured for their dry weight.

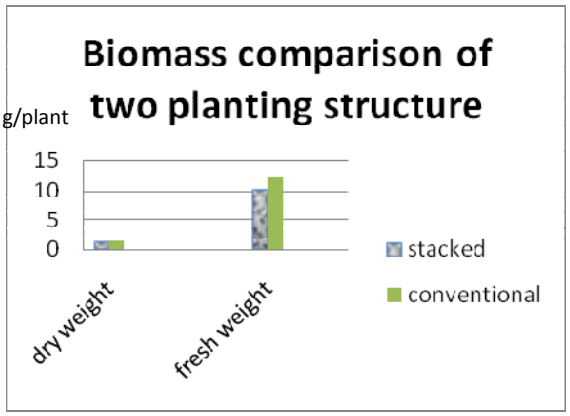
Performance of super intensive kangkung scrubber

Aquaculture effluent was filtered down to 33 micron to minimize solid interference. The filtered effluent is then subjected to the scrubber for 3 days. The control is untreated aquaculture effluent. Nutrient parameters monitored were ammonia, nitrite, nitrate, and phosphate. Readings were taken every 24 hours to determine the ideal water retention time. All treatments and control are done in triplicate set-up.

Growth performance of 'sweet basil' grown in treated and untreated aquaculture effluent

Aquaculture effluent that has undergone the super intensive kangkung scrubber is dosed with commercial water soluble inorganic fertilizer and are used to grow sweet basil. The control for this experiment is the untreated aquaculture effluent which is also used to grow the same crop. The plant height, width, leave area, are monitored every other day for a period of one month to plot its growth rate.

RESULTS AND DISCUSSIONS



The experiment was repeated three times and each time the results were similar. This could be due to two reasons. Firstly, because the experiment site is sea fronting and due to the high structure of the 'Stacked' planting unit, the plants are more susceptible to wind stress. It was observed that the conventional planting structure on site received less wind because it was shielded by other elements of the system (tanks, filters, etc). The other reason could be that the self shading effect of the kangkung hampers the growth performance in the 'Stacked' planting structure. However, this remains unverifiable and further modification is currently in progress to confirm the cause of the growth difference.

'Performance of super intensive kangkung scrubber' experiment and 'Growth performance of 'sweet basil' grown in treated and untreated aquaculture effluent' is still underway at the time of this writing.

REFERENCES AND CITATIONS

[1] Gholamreza Rafiee, Che Roos Saad. Nutrient cycle and sludge production during different stages of red tilapia (Oreochromis sp.) growth in a recirculating aquaculture system. *Aquaculture.* 224 (2005) 109-118.

[2] Jimmy Pan, Huawei Sun, Andre Nduwimana, Yuanyuan Wang, Gendi Zhou, Yibin Ying, Ruihong Zhang. Hydroponic plate/fabric/grass system for treatment of aquacultural wastewater. *Aquaculture Enginering.* 37 (2007) 266-273.

[3] John Colt. Water quality requirements for reuse systems. *Aquaculture Engineering*. 34 (2006) 143-156.

[4] Paul R. Adler, Steven T. Summerfelt, D. Michael Gleen, Fumiomi Takeda. Mechanistic approach to phytoremediation of water. *Ecological Engineering.* 20 (2003) 251-264.

[5] Wilson A. Lennard, Brian V. Leonard. A comparison of three different hydroponic sub-systems (gravel bed, floating and nutrient film technique) in an Aquaponic test system. *Aquaculture International.* 14(2006) 539-550

Genome Analysis of Nervous Necrosis Virus (NNV) Isolate From Different Marine Fish Species in Malaysia

Benny Obrain Manin[1] and Julian Ransangan[1]
[1]Microbiology and Fish Disease Laboratory, Borneo Marine Research Institute,
Universiti Malaysia Sabah, 88999 Kota Kinabalu Sabah, Malaysia
*bennyobrain85@yahoo.com

Abstract
Nervous necrosis virus (NNV) is the causative agent of the viral nervous necrosis (VNN) or viral encephalopathy and retinopathy disease in marine fish. This disease is responsible for most of the mass mortalities cases in hatchery produced marine fish larvae in Malaysia. The genome of this virus consists of two positive-sense RNA molecules which are the RNA1 and RNA2. The RNA1 molecule contains the RdRp gene which is encoding for the RNA-dependent RNA polymerase and the RNA2 molecule contains the Cp gene which is encoding for the viral coat protein. In this study, total RNAs were extracted by using TRIzolTM from 32 fish specimens representing the four most cultured fish species in the Southeast Asian region. The fish specimens were collected from different hatcheries and aquaculture farms in Malaysia and Indonesia. The RNAs were reverse-transcribed into cDNA. Complete coding sequence of RdRp gene was generated using three combinations of PCR primers whereas the complete coding sequence of coat protein gene was generated using a pair of primers. The nucleotide analysis of RdRp gene revealed that the 32 NNV isolates were 94.5-99.7% similar to the RGNNV genotype, 79.8-82.1% similar to SJNNV genotype, 81.5-82.4% similar to BFNNV genotype and 79.8-80.7% similar to TPNNV genotype. However, they showed lower similarities to FHV (9.4-14.2%) and BBV (7.2-15.7%), respectively. On the other hand, nucleotide analysis of Cp gene revealed that the 32 NNV isolates in this study showed high similarity to RGNNV (95.9-99.8%), SJNNV (72.2-77.4%), BFNNV (80.9-83.5%), TPNNV (77.2-78.1%) and TNV (75.1-76.5%). However, as seen in the RdRp gene, the coat protein gene was highly dissimilar to FHV (3.0%) and BBV (2.6-4.1%), respectively. Based on the nucleotide analyses of the two genes, it was found that all the NNV isolates infecting marine fish in Malaysia are belonging to the RGNNV genotype. This has been expected since RGNNV genotype is the widely distributed in the tropical waters and commonly reported infecting wide range of fish hosts in the Southeast Asian region.

Keywords
Nervous Necrosis Virus, RdRp gene, Cp gne, RGNNV, Marine Fish

Calibration of Agent-Based Modeling and Simulation in Urban Studies

Soheil Sabri[1,]*, Ahmad Nazri Muhammad Ludin and Ho Chin Siong
[1]Faculty of Built Environment
Universiti Teknologi Malaysia
*soheil72@voila.fr

Abstract
In this paper, we review the calibration methods for agent-based modeling and simulation that have been applied in most cases so far in urban studies. These are multi-criteria decision analysis and artificial intelligence methods which are analyzed based on the expected results in urban studies. This study tries to highlight the weaknesses and strong points of calibration methods. Ultimately, paper presents conceptual framework for future urban models to come out in more realistic results.

Keywords
Calibration, Agent-Based Modeling, Urban studies, real world systems

INTRODUCTION

The process of urban modeling has transferred from top-down to bottom-up. Besides, the transition has been continued from static to dynamics and from aggregate to disaggregate methods. The new approaches of symbolic urban models have suggested considering the urban entities' behaviors individually. These entities are objects or events in the city that are locating or moving in urban space [1]. The idea of cellular automata (CA) that has been applied in several urban studies, is enough where the behavior of fixed entities is considered in the model, however, the moving objects need to be observed individually in an urban context [2][3][4]. Every object in the city context can be regarded as an "agent", such as buildings, vehicles, persons, and even the firms[1], so the term "agent" can be comprised of fixed and mobile entities. This reveals the fact that CA is type of agent automata[3], but in this type of agent the behavior of mobile entity will have some effects on its future states.

The urban researches are attracted by the disaggregate nature of agent-based modeling. The method has emphasized on objects itself; therefore the technique is highly dependent on improvements of object-oriented computer programming. Although agent-based urban modeling and simulation is in infancy stage, there are several decision making and planning models that have applied this concept. These are such as pedestrian modeling [5], modeling and simulation of segregation [6], and residents decision making for housing choice [3][7].

However, the agent-based urban models have been criticized by scholars during last decade [6][8]. Calibration and validation of the models are the most concerned parameters of modeling and simulation critics. These are the most important parts in modeling and simulation process generaly and in urban studies particularly [3][9].

The imporatnce of calibration is not less than an appropriate formalization of a model. Assigning proper values and parameters in order to representing a real world system is called calibration [9]. The initial significant requirement of calibration process in an urban modeling is the accurate data that is mostly in fine scale also. Therefore, the accuracy in detailed type of data are two main aspects for a healthy calbration.

Despite the requirement of models, urban data are not readily accessible and most of data are weak and uncertain. Albeit there are number of methods to represent the most accurate and real world behaviour of parameters to calibrate the models [10]. Artificial inteligent (AI) in a general term is considered as promising method for calibrating urban models [11][12].

There are several methods in AI which have been applied in urban modeling researches. Expert systems (ES), fuzzy systems (FS), artificial neural networks (ANN), and genetic algorithm (GA) are most applied AI methods in urban studies[10][12][13][14].

Besides AI, multicriteria decision analysis (MCDA) has been applied in several urban dynamic models[15][16][17]. These methods have been applied to retrieve the decision rules as well as calibration methods. Pair-wise comparison is the most common method in MCDA that was used to derive the weight of parameters in agent-based modeling of urban growth in China[18]. Analytic Hierarchy Process (AHP) has been used in several urban modeling practices as a method for calibration as well as deriving transition rules[15][17].

However, there are limitations in applying each method. AI methods are not able to ensure the accuracy of assumptions in defining the parameter

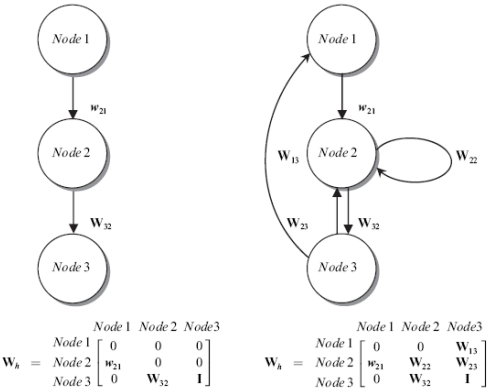
values. MCDM methods are based on expert knowledge but the values remain static during simulation process; which is considered as a source of inaccuracy in modeling process[19].

This research intends to study the possibility of combination of MCDM-AI methods in agent-based urban modeling and simulation. The MCDM part has the ability to derive the expert opinion about an urban phenomenon, then the value can be considered as an initial value in AI to simulate the behaviour of variables.

MULTI-CRITERIA DECISION ANALYSIS

The structure of MCDM is comprised of six components, namely, goal, actors, evaluating criteria, decision alternatives, states of environment, and a set of outcomes[20]. These components are common in all methods of MCDM. Regardless of evaluating the objective or attributes of each decision problem, the structure of decision evaluation and relation of alternatives determine the differences of the methods in MCDM.

Analytic Hierarchy Process (AHP) and Analytic Network process (ANP) are the examples of MCDM. The structure of deciosion alternatives is different in these two. In AHP the actors are asked to evaluate the criteria and their respected parameters in a hierarchical approach. However, the structure of ANP is a feedback structure in which the criteria and parameters inside each criterion can be evaluated based on other criteria and parameters[21]. Figure 1 illustrates the differences between two MCDM approaches.



a) Linear Hierarchical process b) Nonlinear Network process source:[24].

Figure 34. An illustration of AHP and ANP concepts

As mentioned before, there are evidences of using AHP and Pair-wise comparison (PC) methods in modeling and simulation of urban growth[15][18]. So far we have not been able to find the evidence of using ANP in urban modeling and simulation process. This is due to fact that ANP is quite complicated comparing to other methods and needs many questions to be responded in order to achieve the last component of MCDM which is the set of outcomes[22].

In spite of this, the application of ANP method ensures more accurate value for variables in a survey among a few number of experts[23]. The number of criteria and parameters should be limited for sure, otherwise the survey process will take time and the set of outcome is not reliable[21].

ARTIFICIAL INTELLIGENCE

Among the AIs, the methods that are carrying out the biological concepts, such as ANN and GA are mostly used in urban studies[12]. When the behaviour of a system is considered the evolutionary computing that is based on the ability of a system to adopt the behaviour to the changing environment seems to be closer to the concept of urban agents[25].

In contrast, when the nonlinear relation of system components are considered, ANN is more effective. This method also has the ability to adopt in transformations of environment. Once ANN is traned, the model would be extremely efficient computationaly[25].

Know we need to evaluate the performance of each in urban modeling and simulation.

Genetic Algorithm in Urban Studies

There are three aspects in which GA are applied in urban studies. Firstly, GA has been used in urban growth models. It acts as a calibration method in urban growth models[26][27][28]. Secondly, it has been used in planning and decision making where the GA acts as optimizer to find the best plan to fit the requirements[29][30]. Thirdly, it has been applied in urban transporation planning and spatial optimization.
Most of previous studies used GA in CA urban modeling. Recently the literature suggest to utilize GA in agent-based modeling. In this sense, GA can have the role of transition rules derivative method[12]. Although this type of GA application is quite new, authors have emphasized on the promising role of GA in urban ABM[31][32].

Artificial Neural Networks in Urban Studies

The application of ANN in urban studies involves in two main subjects. The frist application is classification which is more related to spatial analysis. A number of literature pointed out to performance of ANN in landslide susceptibility forcasting[33][34]. The second application of ANN is on parameter determination[14][35].
Most of ANN application in urban studies involves in a hybrid approach. for instance, neuro-fuzzy embeded into geographic information systems (GIS) to provoke a decision support system (DSS) in finding the

optimum stand place for taxicaps[36]. Neuro-fuzzy approach has been employed in urban water pipe network failur risk assessment also[37].

ANN has been combined by other AI methods such as GA in deriving rules of complex spatial problems[12], and by expert systems also to increase the accuracy of land-use classification[38][39].

In general, the ANN method has been applied in classification and optimum location choices. The best performance of ANN has been achieved in conjuction with other approaches such as fuzzy systems, GA, and expert systems.

There are other AI approaches that have been applied in urban studies such as simulated anealing (SA), particle swarm technique, tabu search and hill climbing[12]. We considered GA and ANN that are mostly used in urban studies and covered varieties of applications.

CONCLUSION

In this study the most applied methods for calibrating of urban models are reviewed. The literature suggests the promising role of AI in urban modeling and simulation. This efficiency is in two parts of calibration and deriving transition rules.

The literature also suggests to apply AI methods that are derived from biology such as genetic algorithm (GA) and atrificial neural networks (ANN) in urban studies. This might be related to the urban entities which their behaviours and interactions are closely similar to biological sciences.

The study highlighted the advantage of coupling AI systems in performing more accurate analysis. It should be considered that the hybrid of methods should be determined by the nature of problem.
The multi-criteria decision analysis that was applied in both calibration and deriving transition rules can be considered as one of promising tools.

Since the value of MCDM can be acquired from the experts who are more familiar to the issues of place and also form other related stakeholders, from planning point of view, can be a reliable method.

Ananlytic Network Process (ANP) is more reliable since considers the nonlinear relation of parameters. The problem with this method is the static value comparing to dynamic nature of urban parametrs. Although Saaty (2007) suggested to consider the dynamic type of ANP, still there is need to conduct further studies on the issue[40].
To overcome this lack, it seems the combination of ANP-GA can make a reliable tool for agent-based modeling and simulation of urban phenomena. This needs to be examined by feasibility and sensitivity analysis to confirm the validity of suggested combination.

REFERENCES

1. Batty, M., *Model Cities*. 2007, Center for Advanced Spatial Ananlysis (CASA): London.
2. Batty, M., *Approaches to Modeling in GIS: Spatial representation and Temporal Dynamics*, in *GIS, Spatial Analysis, and Modeling*. 2005b, ESRI Press: Redlands California. p. 41-61.
3. Benenson, I. and P.M. Torrens, *Geosimulation Automata-based modeling of urban phenomena*. 2004: John Wiley & Sons.
4. Torrens, P.M., *Automata-Based models of urban systems* in *Advanced Spatial Analysis*. 2003, ESRI Press: Redlands, California. p. 61-80.
5. Batty, M., *Agent-based Pedestrian modelling* in *Advanced Spatial Analysis*. 2003, ESRI: Redlands, California. p. 81-107.
6. Crooks, A., C. Castle, and M. Batty, *Key challenges in Agent-Based Modelling for Geo-Spatial Simulation.* Computers, Environment and Urban Systems, 2008. **32**: p. 417-430.
7. Yao, X. and B. Jiang, *Geospatial modeling of urban environments.* Environment and Planning B: Planning and Design, 2009. **36**: p. 769-771.
8. Yeh, A.G.-O. and X. Li, *Errors and uncertainties in urban cellular automata.* Computers, Environment and Urban Systems, 2006. **30**: p. 10-28.
9. Castle, C.J.E. and A.T. Crooks, *Principles and Concepts of Agent-Based Modeling for Developing Geospatial Simulation*. 2006, Centre for Advanced Spatial Analysis University college London: London.
10. Wu, F., *Calibration of stochastic cellular automata: the application to rural-urban land conversions.* International Journal of Geographical Information Science, 2002. **16**(8): p. 795-818.
11. Openshaw, S. and C. Openshaw, *Artificial Intelligence in Geography*. 1997, Chichester: John Wiley & Sons.
12. Wu, N. and E. Silva, *Artificial Intelligence Solutions for Urban Land Dynamics: A Review.* 2010. **24**(3): p. 246-265.
13. Liu, Y., *Modelling Urban Development with Geographical Information Systems and Cellular Automata*. 2009, Boca Raton: CRC Press, Taylors & Francis Group.
14. Li, X. and A.G.-O. Yeh, *Calibration of cellular automata by using neural networks for the simulation of complex urban systems.* Environment and Planning A, 2001. **33**: p. 1445-1462.
15. Wu, F., *SimLand: a prototype to simulate land conversion through the integrated GIS and CA with AHP-derived transition rules.* Int. J. Geographical Information Science, 1998b. **12**(1): p. 63-82.

16. Wu, F. and C.J. Webster, *Simulation of land development through the integration of cellular automata and multicriteria evaluation.* Environment and Planning B: Planning and Design, 1998. **25**(1): p. 103-126.
17. Wu, F. and C.J. Webster, *Simulating artificial cities in a GIS environment: urban growth under alternative regulation regimes.* International Journal of Geographical Information Science, 2000. **14**(7): p. 625-648.
18. Li, X. and L. Xiaoping, *Embedding sustainable development strategies in agent-based models for use a planning tool.* International Journal of Geographical Information Science, 2008. **22**: p. 21-45.
19. Sabri, S., et al. *Conceptual Design For An Integrated Geosimulation And Analytic Network Process (ANP) In Gentrification Appraisal*. in *Computer in Urban Planning and Urban Management*. 2009. Hong Kong: CUPUM 2009.
20. Malczewski, J., *GIS and Multicriteria Decision Analysis* 1999, New York: John Wily & Sons.
21. Saaty, T.L. and L.G. Vargas, *Decision Making With The Analytic Network Process, Economic, Political, Social and Technological Applications with Benefits, Opportunities, Costs and Risks*. 2006, pittsburgh: Springer.
22. Pourebrahim Abadi, S., *Integrated coastal land use development; using Analytic Network Process and GIS: Case of Kuala Langat District, Malaysia*, in *PhD Thesis*. 2008, Unpublished: University Putra Malaysia, Selangore, Malaysia.
23. Sabri, S. and A. Yakuup. *Multi-Criteria decision making for urban sprawl, using Analytic Network Process and GIS, Case of Iskandar Malaysia Region*. in *Map Asia 2008*. 2008 a. Kuala Lumpur: GIS Development.
24. Wey, W.-M. and K.-Y. Wu, *Interdependent urban renewal project selection under the consideration of resource constraints.* Environment and Planning B: Planning and Design, 2008. **35**: p. 122-147.
25. Negnevitsky, M., *Artificial Intelligence A Guide to Intelligent Systems*. 2005, Harlow, England: Pearson Education Limited.
26. Jenerette, G.D. and J. Wu, *Analysis and simulation of land-use change in the central Arizona - Phoenix region, USA.* 2001. **16**: p. 611-626.
27. Al-Kheder, S., J. Wang, and S. Jie. *Cellular automata urban growth model calibration with genetic algorithms*. 2007: Urban Remote Sensing Joint Event.
28. Blecic, I., A. Cecchini, and G.A. Trunfio, *A Multi-Agent Geosimulation Infrastructure for Planning*, in *Geocomputation and Urban Planning*. 2009, Springer-Verlag: Heidelberg. p. 237-254.
29. Semboloni, F., *Optimization and Control of the Urban Spatial Dynamics.* 2004. **5**(2): p. 204-216.
30. Lowry, M.B., *Coordinated Regional and City Planning Using a Genetic Algorithm, A Masters Thesis*. 2004, Brigham Young University.
31. Zhang, X. and M.P. Armstrong, *Gnentic algorithms and the corridor location problem: multiple objectives and alternative solutions.* 2008. **35**: p. 148-168.
32. Wilson, A., *Urban and regional dynamics - 3: 'DNA' and 'genes' as a basis for constructing a typology of areas*. 2008, Centre for Advanced Spatial Analysis, University College London: London.
33. Ermini, L., F. Catani, and N. Casagli, *Artificial Neural Networks applied to landslide susceptibility assessment.* 2005. **66**: p. 327-343.
34. Yilmaz, I., *Landslide susceptibility mapping using frequency ratio, logistic regression, artificial neural networks and their comparison: A case study from Kat landslides (Tokat-Turkey).* 2009. **35**: p. 1125-1138.
35. Li, X. and A.G.-O. Yeh, *Modelling sustainable urban development by the integration of constrained cellular automata and GIS.* International Journal of Geographical Information Science, 2000. **14**(2): p. 131-152.
36. Ocalir, E.V., O.Y. Ercoskun, and R. Tur, *An integrated model of GIS and fuzzy logic (FMOTS) for location decisions of taxicab stands.* 2010. **37**: p. 4892–4901.
37. Christodoulou, S., et al., *Risk-based asset management of water piping networks using neurofuzzy systems.* 2009. **33**: p. 138–149.
38. Pijanowski, B.C., et al., *Using neural networks and GIS to forecast land use changes: a Land Transformation Model.* 2002. **26**: p. 553–575.
39. Liu, X.-H., A.K. Skidmore, and H. Van Oosten, *Integration of classification methods for improvement of land-cover map accuracy.* 2002. **56**: p. 257– 268.
40. Saaty, T.L., *Time dependent decision-making; dynamic priorities in the AHP/ANP: Generalizing from points to functions and from real to complex variables.* Mathematical And Computer Modelling, 2007. **46**: p. 860-891.

Effect of Substrate Material on the Deposition of Polycrystalline Diamond

T. M. Yong[1], E. Hamzah[1]* and K. Chee M. F.[1]
[1]Universiti Teknologi Malaysia
*esah@fkm.utm.my

Abstract
Chemical Vapour Deposition method offers a technique to deposite synthetic diamond with extreme hard properties very similar to natural diamond on other materials. This paper describes a comparison of two substrates i.e. Silicon Nitride(Si_3N_4) and Tungsten Carbide (WC), two materials very common as cutting tools it selves, diamond coated in a same Hot Filament Chemical Vapour Deposition chamber together. The surface pretreatment of Si_3N_4 was varied, simply using mechanical treatment and chemical treatment with similar seeding method while the seeding process of the WC substrate was varied with different concentration of Silicon Carbide (SiC) with the chemical treatment being constant. FESEM, Raman Spectra and AFM analysis are used as comparison between substrates. Results show that chemical treatment gives better quality PCD compared with mechanical pretreatment for Si_3N_4 while Seeding process of 5g/liter gives the best quality diamond coating in comparison to 1g/liter and 10g/liter. Comparison of the two substrates, WC shows a better Polycrystalline Diamond (PCD) deposition in comparison to Si_3N_4.

Keywords
Polycrystalline Diamond, HFCVD, Substrates: Si_4N_3, WC, Diamond Coated Tools

INTRODUCTION

Diamond coated tools are getting more recognition in their abilities to cut difficult non-ferrous materials in the machining world due to the extreme properties of diamond. One economical method is to deposite diamond as a coating using methane as a precursor rather then making a whole tool of diamond is called Hot Filament Chemical Vapour Deposition (HFCVD) method.

It is unconventional to deposite PCD on different substrates together due that different materials have different optimized deposition parameters. There have been huge amount of work done in optimizing these parameters for individual substrates whether it's the preparation method [1, 2] or the deposition parameters it selves [3, 4, 5, 6]. Thus the objective of this study is to bridge deposition of PCD on both Silicon Nitride (Si_3N_4) and Tungsten Carbide (WC).

There are previous studies on multi-substrate deposition. For example deposition on Cu, Si, WC, and Mo together[7]. While another research discussed on mechanism and prediction of failure of PCD on Si_3N_4 and WC[8].

This study focuses on the surface morphology and quality of PCD deposited on two different substrates i.e. Silicon Nitride(Si_3N_4) and Tungsten Carbide (WC). Both materials are often involved in high end machining as cutting tools.

METHODOLOGY

This section explains the experimental method. the material used as substrates are Silicon Nitride (Si_3N_4) and Tungsten Carbide 6% Cobolt. Samples obtained are cut into 7mm x 7mm x 4mm sizes.

Sample Preparation

Before undergoing deposition process the substrates substrate surfaces are treated to enhance nucleation and growth of diamond. First, the substrate material undergoes steaming to maintain the surface cleanness of the surface before undergoing any treatment.

Surface preparation of tungsten carbide substrate is done in 2 steps i.e. chemical treatment and followed by a seeding process. The chemical treatment involves etching with Murakami's solution: 10g KOH + 10g K3[Fe(CN)6] + 100 ml H_2O in ultrasonic bath for 20 minutes followed by second etching process is done by using acid solution of HNO_3 + H_2O_2 in ratio of 1:9 under ultrasonic vibration also. This etching process is ended with steaming to remove any chemicals left.

The seeding treatment involves solution as in Table 1 where the fixed solution is mixed with Silicon Carbide, SiC mixture and substrate is seed in an ultrasonic bath for 5 minutes. 3 different SiC concentration were experimented.

Table 1: Seeding solution for tungsten carbide substrate

Sample code	Fixed solution	Silicon Carbide concentration
WC1	10% Tikapour + 90% distilled water + 0.8g/liter of diamond powder (Capacity of the basin =10.7 liter)	1g/liter
WC2		5g/liter
WC3		10g/liter

Surface pretreatment of silicon nitride substrates is carry out in 2 ways i.e. by chemical and mechanical methods followed by Seeding as shown in Table 2.

Table 2: Chemical and Mechanical surface pretreatment of Silicon Nitride substrate

Sample code	Surface pretreatment	Seeding Procedures
SN1	Chemical etching (30min) 60% HNO3 + 47% HF (50ml)	10% Tikapour + 90% distilled water + 0.8g/liter of diamond powder + 0.5g/liter SiC (Capacity of the basin Is 10.7 liter) (5min)
SN2	Mechanical blasting with SiC particles	

The seeding treatment however is not varied for both mechanical and chemical treatments. The seeding solution is as stated in Table 2

Deposition Parameters

After the substrate is pretreated, the substrates undergo diamond deposition with filament temperature of 2270K for 22 hours with parameters table 3.

Table 3: Deposition Parameters

Chamber Pressure 10-100 torr
Filament Temperature 2270 °C ±50°C
Substrate Temperature 800 – 1000 °C
Gas Flow Rate 200 sccm
Gas composition 1-3% CH_4 in H_2

Analysis

Four kinds of analysis were done i.e. surface morphology (using Field Emission Scanning Electron Microscopy, FESEM), crystal structural characteristic (using Raman Spectrometer) and surface roughness (using Atomic Force Microscope, AFM)

RESULTS AND DISCUSSION

Surface Morphology

The surface morphology of the deposited diamond are shown in Figure 1 and Figure 2.

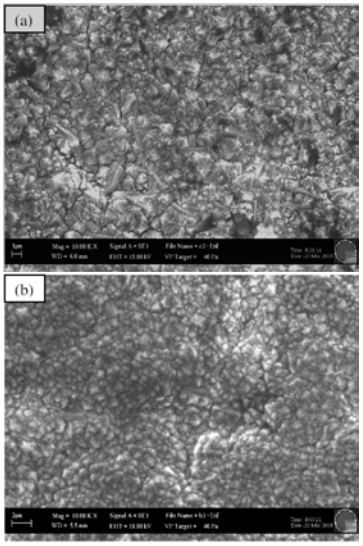


Figure 1: Scanning electron micrograph of polycrystalline diamond coated on Silicon Nitride (Si_3N_4) (a) chemical pretreatment and (b) mechanical pretreatment followed by seeding

Figure 1 roughly shows that the diamond morphologies observed from mechanical pretreatment has higher density of PCD compared with the diamond density from chemical pretreatment.

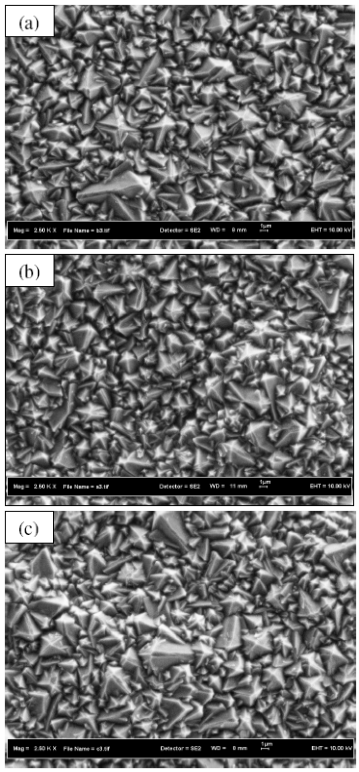


Figure 2: Scanning electron micrograph of polycrystalline diamond coated on Tungsten Carbide (WC) seeded with (a) 1g/liter and (b)

5g/liter (c) 10g/liter of Silicon Carbide powder

Figure 2 (a) and (b) shows similar surface morphologies where as Figure 2 (c) shows slightly larger grain size. Thus we can conclude that lower concentration of SiC powder during seeding has no effect on the deposition of diamond where as the concentration of 10g/liter is able to increase the diamond grain size.

Crystal Structural Characteristics

The crystal structural characteristic or diamond quality of the PCD deposited on Si_3N_4 and WC substrates are are interpreted through Raman spectra shown in Figure 3 and Figure 4. While table 4summarises the Raman Spectra Data.

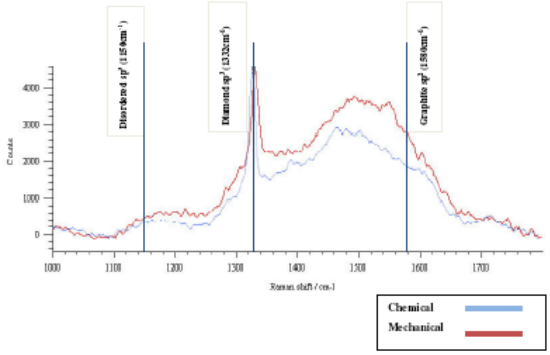


Figure 3: Raman spectra of polycrystalline diamond between 1000 to 1800 cm-1 that undergo chemical and mechanical pretreatment on silicon nitride substrates (Si_3N_4)

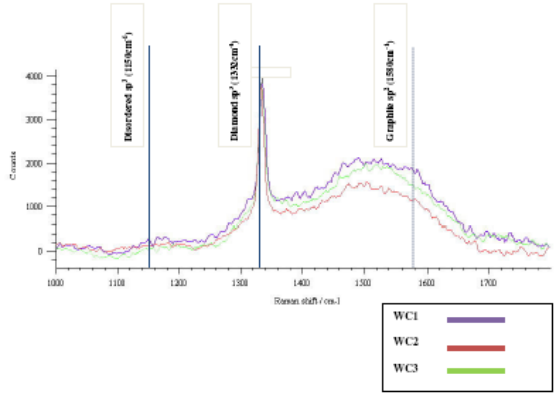


Figure 4: Raman spectra of polycrystalline diamond between 1000 to 1800 cm-1that varying in the silicon carbide powder in the seeding process on tungsten carbide substrate (WC)

Results from the Raman spectra of polycrystalline diamond coated on Si_3N_4 and WC can be analyzed for both the phase purity, which is defined by the diamond/graphite Raman spectra ratio, and the crystalline quality is defined by the Full Width at Half Maximum (FWHM) of the diamond Raman line [XXX]. A sharp peak of approximately 1332cm-1 of Raman line which is an evidence of the diamond phase. All Raman spectra show two broad band centered at 1150 and 1580cm^{-1} which are respectively, D-band (for ''disorder-band'') and G-band (for ''graphite-band''). Disordered amorphous and graphitic carbon structures effect is even less in PCD on WC. Diamond peak of PCD Si_3N_4 is about 1330cm-1 shows existence of tensile residual stress while Diamond peak of PCD on WC is about 1335cm-1 shows compression residual stress. The smaller the FWHM value the higher the purity of the diamond. Single crystal diamond FWHM value is about 2cm^{-1}, thus the values of 11.6 to 14.17cm^{-1} show very high purities for PCD. Thus PCD coating is practically constituted of significant diamond with disordered amorphous and graphitic carbon structures.

Table 4: A Summary of Raman Spectra Data Analysis

Code	Diamond		FWHM (cm^{-1})	Diamond Quality (%)	Residual Stress (GPa)
	Raman Shift (cm^{-1})	Maximum intensity (counts)			
SN1	1330.58	4528.2	14.173	0.9894	0. 8051
SN2	1330.16	7419.43	12.002	0.9928	1. 0433
WC1	1335.02	3863.18	13.253	0.9928	-1. 7123
WC2	1335.14	4482.22	11.602	0.9952	-1. 7861
WC3	1335.08	4778.56	13.078	0.9933	-1. 7464

Topography and Surface Roughness

Figure 5 and 6 shows the three dimension (3D) AFM topography of PCD coated on Si_3N_4 and WC substrates.

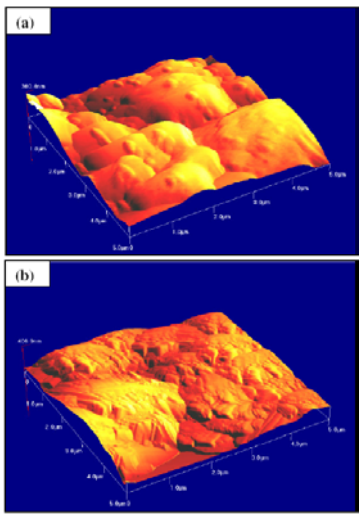


Figure 5: AFM topography of polycrystalline diamond coated on Silicon Nitride substrate which undergo (a) chemical (b) Mechanical pretreatment

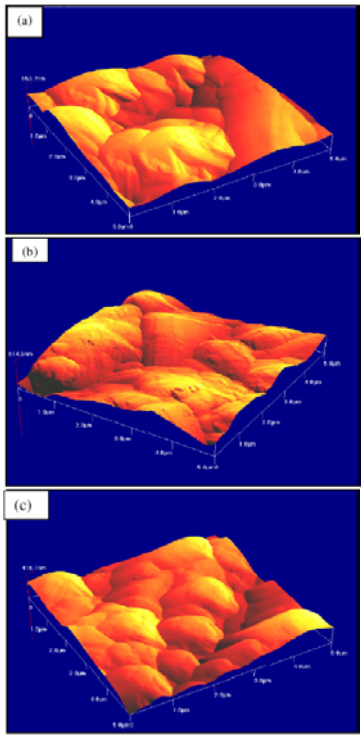


Figure 5: AFM topography of polycrystalline diamond coated on tungsten carbide with concentration (a) 1g/liter, (b) 5g/liter, (c) 10g/liter of silicon carbide powder in the seeding solution

AFM analysis show in Table 2 that surface roughness of PCD on Si_3N_4 is lower then PCD on WC.

Table 4.3: Surface roughness of PCD coated on Si_3N_4 and WC

Code	Rz (nm)	Rrms (nm)
SN1	102.4	61.17
SN2	220.6	69.73
WC1	307.1	108.3
WC2	340.3	108.6
WC3	204.2	80.62

DISCUSSION AND CONCLUSION

FESEM and AFM results show correlation of PCD surface topology on Si_3N_4 and WC substrates. The observation worth noting is that the grains of PCD on Si_3N_4 are smaller then PCD on WC. This also explains the lower surface roughness of PCD on Si_3N_4 compared to PDC on WC. More importantly, smaller grains also mean more volume of grain boundaries, i.e. more disordered carbon and graphite phases. This correlates with Raman Spectrometry results.

The Raman analyses were focused on existence of PCD and thus successfully show the significance existence of PCD. Nevertheless other less obvious should be noted here also. Existence of two board bands centered around 1150 and 1580cm^{-1} which are respectively, D-band (for ''disorder-band'') and G-band (for ''graphite-band''). Notice also the compressive residual stress in PCD on WC can be due to thermal shrinkage during cooling down.

Overall PCD quality shows that chemical treatment gives better quality PCD compared with mechanical pretreatment for Si_3N_4 while Seeding process of 5g/liter gives the best quality diamond coating in comparison to 1g/liter and 10g/liter. Comparison of the two substrates, WC shows a better PCD deposition in comparison to Si_3N_4.

REFERENCES

[1] Riccardo Polini, Fabio Bravi, Fabrizio Casadei, Pierangelo D'Antonio, Enrico Traversa, *Diamond and Related Materials.,* 11 (2002) 726-730.

[2] Shibuya, Y. and M. Takaya, *Surface and Coatings Technology*, (1998). 106(1): p. 66-71.

[3] C.D. Torres, P.J. Heaney, A.V. Sumant, M.A. Hamilton, R.W. Carpick, F.E. Pfefferkorn *International Journal of Machine Tools & Manufacture* 49 (2009) 599-612

[4] Sam Zhang & Nasar Ali. Nanocomposite Thin Films And Coatings: Processing, Properties and Performance 2006, Imperial College Press.

[5] F. Qin, Y.K. Chou, D. Nolen, R.G. Thompson, *Surface & Coating Technology* (2009) Article in Press

[6] Fanghong Sun, Yuping ma, Bin Shen, Zhiming Zhang and Ming Chen, *Diamond and Related Materials*, 18 (2009) 276–282

[7] Gordana S. Ristic, Zarko D. Bogdanov. Slavica Zec, Nebojsa Romcevic, Zorana Dohcevic-Mitrovic and Scepan S. Miljanic, *Materials Chemistry and Physics* 80 (2003) 529-536

[8] Zhou, L.-P., Sun, X.-Y., Li, D.-Y., Li, S.-L., Chen, X.-H., Transactions of Nonferrous Metals Society of China (English Edition) 14 (SUPPL. 2), pp. 229-233

Exact Solutions Of Accelerated .Ows For A Generalized Burgers' Fluid. I: The Case $\gamma<\lambda^2/4$

Ilyas Khan, K. Fakhar, M. Imran
Department of Mathematics, Faculty of Science, Universiti Teknologi Malaysia
81310 UTM Skudai
ilyaskhanqau@yahoo.com, kamranfakhar@yahoo.com, jeotarar@yahoo.com

Abstract
An analysis is presented to develop the exact solutions for the accelerated ows of a generalized Burgers' fluid when the relaxation times satisfying the condition $\gamma<\lambda^2/4$. The corresponding expressions for the velocity .eld and associated tangential stress are obtained by using Laplace transform for the following two problems: (i)flow induced by constantly accelerating plate and (ii) .ow induced by variable accelerated plate. The obtained solutions are presented through simple or multiple integrals in terms of Bessel functions. Further, the solutions for Newtonian, oldroyd-B and Burgars fluids have also been obtained here as the limiting cases of our solutions, which serve as a useful mathematical cheek.

Keywords
Generalized Burgers' fluid, Laplace transform, Exact solutions.